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INTRODUCTION

A COMPREHENSIVE INFORMATION SERVICE

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Certain publications abstracted in *STAR* are given analytic treatment, with citations and abstracts of daughter items following immediately after the parent document. When the subject content of a daughter differs from that of its parent, a cross-reference citation is printed at the end of the category to which the daughter would normally have been assigned.

Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

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IAA is available on subscription from the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York, NY 10017, at the following annual rates:

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA*

Thesaurus should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: heirarchical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

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Denver, Colorado 80225

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Federal Republic of Germany

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 713
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 717
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 717
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 726
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 730
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 732
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

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08 Computers 736
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 741
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 745
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 747
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 749
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 756
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 769
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 776
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers 780
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18 Materials, Nonmetallic 787
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 790
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 791
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 795
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

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Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

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Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

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Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

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Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

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28 Propulsion Systems 811
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 813
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 815
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 820
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 824
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 835
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

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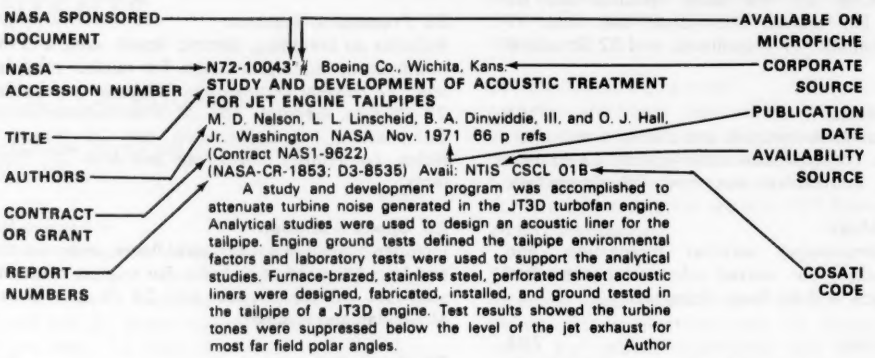


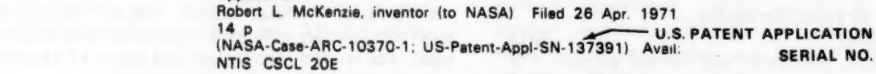
N72-10043*# Boeing Co., Wichita, Kans.
STUDY AND DEVELOPMENT OF ACOUSTIC TREATMENT FOR JET ENGINE TAILPIPES
M. D. Nelson, L. L. Linscheid, B. A. Dinwiddie, III, and O. J. Hall, Jr. Washington NASA Nov. 1971 66 p refs
(Contract NAS1-9622)
(NASA-CR-1853; D3-8535) Avail: NTIS CSCL 01B

A study and development program was accomplished to attenuate turbine noise generated in the JT3D turbofan engine. Analytical studies were used to design an acoustic liner for the tailpipe. Engine ground tests defined the tailpipe environmental factors and laboratory tests were used to support the analytical studies. Furnace-brazed, stainless steel, perforated sheet acoustic liners were designed, fabricated, installed, and ground tested in the tailpipe of a JT3D engine. Test results showed the turbine tones were suppressed below the level of the jet exhaust for most far field polar angles. Author

PATENT CITATION

N72-12440* Auburn Research Foundation, Inc., Ala.
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA)
Issued 13 Jul. 1971 14 p Filed 2 Oct. 1969 Supersedes N70-22250 (08-09, p 1645
(NASA-Case-MFS-20180; US-Patent-3,593,194; US-Patent-Appl-SN-863276; US-Patent-Class-331-94.5; US-Patent-Class-350-1; US-Patent-Class-350-312) Avail: US Patent Office CSCL 20E

PATENT APPLICATION CITATION



N72-10432*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC INFRARED GASDYNAMIC LASER Patent Application
Robert L. McKenzie, inventor (to NASA) Filed 26 Apr. 1971 14 p
(NASA-Case-ARC-10370-1; US-Patent-Appl-SN-137391) Avail: NTIS CSCL 20E

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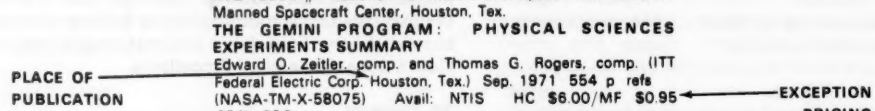

N72-10856*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE GEMINI PROGRAM: PHYSICAL SCIENCES EXPERIMENTS SUMMARY
Edward O. Zeitler, comp. and Thomas G. Rogers, comp. (ITT Federal Electric Corp., Houston, Tex.) Sep. 1971 554 p refs
(NASA-TM-X-58075) Avail: NTIS HC $6.00/MF $0.95 CSCL 22C

Results and findings of physical sciences experiments performed in the Gemini program are presented. The summary contains descriptions of selected studies in the fields of astronomy, navigation, radiation, geophysics, meteorology, photography, and communications. For individual titles, see N72-10857 through N72-10891.

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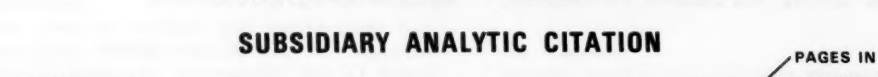
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N72-10862*# Geological Survey, Flagstaff, Ariz.
EXPERIMENT S029: EARTH-MOON LIBRATION REGIONS PHOTOGRAPHY
Elliott C. Morris *In* NASA. Manned Spacecraft Center The Gemini Program: Phys. Sci. Expt. Sum. Sep. 1971 p 71-75
(See N72-10856 01-30)
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VOLUME 10 NUMBER 6 / MARCH 23, 1972

Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N72-14983*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

REYNOLDS NUMBER EFFECT ON OVERALL PERFORMANCE OF A 10.8-CENTIMETER (4.25-INCH) SWEPTBACK BLADED CENTRIFUGAL COMPRESSOR

Carl Weigel and Calvin L. Ball Washington Jan. 1972 22 p refs

(NASA-TN-D-6640; E-6586) Avail: NTIS CSCL 01A

The performance data were taken at 50,000 rpm, using argon gas. As the Reynolds number was reduced from near design value to 30 percent of design, the maximum efficiency decreased about 1.5 percentage points. Reducing the Reynolds number from 30 percent to approximately 10 percent of design caused the maximum efficiency to decrease another 2.5 percentage points. The variation in loss with Reynolds number is compared with inverse power relation of loss with Reynolds number. Author

N72-14984*# Massachusetts Inst. of Tech., Cambridge.

SUBSONIC AND SUPERSONIC STATIC AERODYNAMIC CHARACTERISTICS OF A FAMILY OF BULBOUS BASE CONES MEASURED WITH A MAGNETIC SUSPENSION AND BALANCE SYSTEM

M. Vlajinac, T. Stephens, G. Gilliam, and N. Pertsas Washington NASA Jan. 1972 63 p refs

(Contract NAS1-8658)

(NASA-CR-1932; TR-166) Avail: NTIS CSCL 20D

Results of subsonic and supersonic wind-tunnel tests with a magnetic balance and suspension system on a family of bulbous based cone configurations are presented. At subsonic speeds the base flow and separation characteristics of these configurations is shown to have a pronounced effect on the static data. Results obtained with the presence of a dummy sting are compared with support interference free data. Support interference is shown to have a substantial effect on the measured aerodynamic coefficient. Author

N72-14985*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF GROOVED CASING TREATMENT ON THE FLOW RANGE CAPABILITY OF A SINGLE-STAGE AXIAL-FLOW COMPRESSOR

Everett E. Bailey Washington Jan. 1972 15 p refs

(NASA-TM-X-2459; E-6560) Avail: NTIS CSCL 20D

Comparisons of the results of testing a single-stage axial-flow compressor with a solid-wall casing and with grooved casings are presented. The depth, location, and number of circumferential grooves in the casing over the casing over the rotor tip were varied. The near-stall weight flow was lower than that with the solid-wall casing for all but one grooved configuration indicating an improvement in the stall margin. The greatest reduction in the near-stall weight flow was noted for the configuration with five grooves located over the blade midchord region. Author

N72-14986*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF TRAILING EDGE GEOMETRY AND THICKNESS ON THE PERFORMANCE OF CERTAIN TURBINE STATOR BLADING

Herman W. Prust, Jr. and Ronald M. Helon Washington Jan. 1972 22 p refs

(NASA-TN-D-6637; E-6613) Avail: NTIS CSCL 20D

The experimental and analytical investigation included solid blades with five different trailing-edge thicknesses and four different trailing-edge geometries. One of the geometries was round, one was square, one was tapered from the suction surface, and the other tapered from the pressure surface. One of the trailing-edge thicknesses was sharp edged; the other four thicknesses were equivalent to about 5, 11, 16, and 20 percent of the blade throat width. The experimental results show increased efficiency loss for increased trailing-edge thickness for all trailing-edge geometries. The blade with round trailing edge, equal to about 11 percent of the blade throat width, had 60 percent more loss than the sharp-edged blade. For the same trailing-edge thickness, square trailing edges caused more loss than round trailing edges, and the tapered trailing edges caused about the same loss as the round trailing edges. Author

N72-14987*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN AND PERFORMANCE OF AN 0.8 HUB-TIP RATIO AXIAL FLOW PUMP ROTOR WITH A BLADE TIP DIFFUSION FACTOR OF 0.55

Donald C. Urasek Washington Jan. 1972 27 p refs

(NASA-TM-X-2485; E-6423) Avail: NTIS CSCL 13I

A 22.9-centimeter diameter axial flow rotor with a 0.8 hub-tip radius ratio, a design flow coefficient of 0.466, and a blade tip design diffusion factor of 0.55 was tested in cold water under both cavitating and noncavitating conditions. Radial surveys of the flow conditions at the rotor inlet and outlet were made. At design flow, the rotor produced an overall headrise coefficient of 0.360 with an overall efficiency of 95.0 percent. The efficiency remained greater than 88 percent over the entire flow coefficient range which varied from 0.350 to 0.615. Author

N72-14988*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INVESTIGATION OF A MIXED COMPRESSION AXISYMMETRIC INLET AT MACH NUMBER 5.3
Eldon A. Latham, Norman E. Sorenson, and Donald B. Smeltzer Washington Jan. 1972 35 p refs
(NASA-TN-D-6647; A-4160) Avail: NTIS CSCL 20D

The hypersonic diffuser portion of an uncooled high performance mixed compression, axisymmetric inlet suitable for subsonic burning engines was designed and tested. Performance of a model with a 25.4-cm capture diameter was measured in a wind tunnel and the results were compared with theoretical predictions calculated by a comprehensive computer program. All tests were conducted at a Mach number of 5.3 at a total temperature of 667 K and a total pressure of 11.57 atm. The angle of attack ranged from 0 to + or - 3 deg. Performance at angle of attack remained high. Reasonably high performance in the throat (maximum throat pitot-pressure recovery of 77 percent and an average value of 58 percent) was obtained at 0 deg angle of attack with relatively large amounts of boundary-layer bleed (11 to 22 percent of the capture mass flow). The computer program used in the design of this inlet is considered marginally adequate for predicting hypersonic inlet flow fields. Although the program as it now exists is very useful, an improved computer program that more accurately predicts the boundary layer and the shock-wave-boundary-layer interaction and accounts for boundary-layer bleed should be developed for reliability predicting hypersonic inlet flow fields. Author

N72-14989*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF 1380 FOOT PER SECOND TIP-SPEED AXIAL-FLOW COMPRESSOR ROTOR BLADE TIP SOLIDITY OF 1.5
Calvin L. Ball, David C. Janetzke, and Lonnie Reid Washington Jan. 1972 100 p refs
(NASA-TM-X-2379; E-5723) Avail: NTIS CSCL 20D

This presents the aerodynamic design parameters along with the overall and blade element performance of an axial-flow compressor rotor designed to study the effects of blade solidity on efficiency and stall margin. At design speed the peak efficiency was 0.892 and occurred at an equivalent weight flow of 65.0 lb/sec. The total pressure ratio was 1.83 and the total temperature ratio was 1.215. Design efficiency, weight flow, pressure ratio, and temperature ratio were 0.824, 65.3, 1.65, and 1.187, respectively. Stall margin for design speed was 10 percent based on the weight flow and pressure ratio values at peak efficiency and just prior to stall. Author

N72-14990*# Rochester Applied Science Associates, Inc., N.Y.
DEVELOPMENT AND APPLICATION OF A METHOD FOR PREDICTING ROTOR FREE WAKE POSITIONS AND RESULTING ROTOR BLADE AIR LOADS. VOLUME 1: MODEL AND RESULTS
S. Gene Sadler Washington NASA Dec. 1971 123 p refs (Contract NAS1-8448)
(NASA-CR-1911; Rept-69-11-Vol-1) Avail: NTIS CSCL 01B

Rotor wake geometries are predicted by a process similar to the startup of a rotor in a free stream. An array of discrete trailing and shed vortices is generated with vortex strengths corresponding to stepwise radial and azimuthal blade circulations. The array of shed and trailing vortices is limited to an arbitrary number of azimuthal steps behind each blade. The remainder of the wake model of each blade is an arbitrary number of trailing vortices. Vortex element end points were allowed to be transported by the resultant velocity of the free stream and vortex-induced velocities. Wake geometry, wake flow, and wake-induced velocity influence coefficients are generated by this program for use in the blade loads portion of the calculations. Blade loads computations include the effects of nonuniform inflow due to a free wake, nonlinear airfoil characteristics, and response of flexible blades to the applied loads. Computed wake flows and blade loads are compared with experimentally measured data. Predicted blade loads, response and shears and moments are obtained for a model rotor system having two independent rotors. The effects of advance ratio, vertical separation of rotors, different blade radius ratios, and different azimuthal spacing of the blades of one rotor with respect to the other are investigated. Author

N72-14991# Joint Publications Research Service, Washington, D.C.
AEROHYDRODYNAMIC CHARACTERISTICS OF HYDROFOILS
I. T. Yegorov 14 Jan. 1972 32 p refs Transl. into ENGLISH from the book "Gidrodinamika Bystrokhodnykh Sudov" Chapter 53, 2d Ed. p 397-421
(JPRS-54935) Avail: NTIS

The effect of the water surface on the aerohydrodynamic characteristics of carrier surfaces moving over the water surface is discussed. The aerodynamic forces acting on a wing of infinite length moving close to the interface between two media of differing densities are analyzed. A Laplace equation is used to find the attenuation condition of the induced velocities far from the body, and the limiting condition on the interface. Mathematical models to express the pressure distribution and air circulation are provided. Author

N72-14992*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE DETERMINATION OF THE GEOMETRIES OF MULTIPLE-ELEMENT AIRFOILS OPTIMIZED FOR MAXIMUM LIFT COEFFICIENT Ph.D. Thesis - Illinois Univ., Urbana
Allen Wen-shin Chen 1971 96 p refs
(NASA-TM-X-67591) Avail: NTIS CSCL 01A

Optimum airfoils in the sense of maximum lift coefficient are obtained by a newly developed method. The maximum lift coefficient is achieved by requiring that the turbulent skin friction be zero in the pressure rise region on the upper surface. Under this constraint, the pressure distribution is optimized. The optimum pressure distribution consists of a uniform stagnation pressure on the lower surface, a uniform minimum pressure on the upper surface immediately downstream of the front stagnation point followed by a Stratford zero skin friction pressure rise. When multiple-element airfoils are under consideration, this optimum pressure distribution appears on every element. The parameters used to specify the pressure distribution on each element are the Reynolds number and the normalized trailing edge velocity. The newly developed method of design computes the velocity distribution on a given airfoil and modifies the airfoil contour in a systematic manner until the desired velocity distribution is achieved. There are no limitations on how many elements the airfoil to be designed can have. Author

N72-14993# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
THE NONLINEAR WING THEORY BY K. GERSTEN [UEBER DIE NICHTLINEARE TRAGFLAECHENTHEORIE VON K. GERSTEN]
D. Nikolitsch Bonn Bundeswehramt 1971 85 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-71-20) Avail: NTIS; Bundeswehramt: 25 DM

The Gersten nonlinear wing theory is extended to include compressibility effects in the subsonic range due to the Prandtl-Glauert factor. It was found that the Gersten numerical solution has limited use, and therefore had to be modified. Results applied to the aerodynamic center determination are compared with the linear wing theory of E. Truckenbrodt. The convergence behavior on the nonlinear theory deviates from that of the linear theory and represents a problem with respect to the usability of the entire theory. Coefficients of the nonlinear wing theory are indicated as a function of wing geometry and Mach number. Author (ESRO)

N72-14994# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
APPLICATION OF K. GERSTEN'S NONLINEAR WING THEORY TO TRANSONIC FLOW [UEBER DIE ANWENDUNG DER NICHTLINEAREN TRAGFLAECHENTHEORIE VON K. GERSTEN AUF DEN FALL DER SCHALLANSTROEMUNG]
D. Nikolitsch Bonn Bundeswehramt 1971 50 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-71-21) Avail: NTIS; Bundeswehramt: 25 DM

From lifting surface theory at subsonic range, integral equations are derived that are valid for Mach number 1. These equations also describe the case of vanishing aspect ratio. The forms of these equations allow exact solutions of load distributions and lift coefficients to be stated for wings with leading edges formed by parabolic, elliptic, or circular arcs. This theory imposes the restriction of straight trailing edge. Author (ESRO)

N72-14995# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
THREE COMPONENT MEASUREMENTS ON SYSTEMATICALLY VARIED NOSE-CYLINDER CONFIGURATIONS [DREI-KOMPONENTEN-MESSUNG IM TRANSSONISCHEN GESHWINDIGKEITSBEREICH AN SYSTEMATISCH VARIIERTEN BUG-ZYLINDER-KONFIGURATIONEN]
H. Esch (DFVLR), K. Hartmann (DFVLR), and H. Barth Bonn Bundeswehramt 1971 35 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-71-23) Avail: NTIS; Bundeswehramt: 25 DM

A survey is made of systematic force measurements on slender nose cylinder configurations at Mach numbers from 0.5 to 1.5 arid angles of attack up to 15. The Reynolds numbers, with reference to cylinder diameter, range from 400,000 to 1,200,000. The results are also presented as data sheets.
Author (ESRO)

N72-14996# Royal Aircraft Establishment, Farnborough (England).
THE INFLUENCE OF NEAR-WAKE ASSUMPTION ON THE LIFTING CHARACTERISTICS OF A ROTOR BLADE
J. G. Woodley Mar. 1971 77 p refs
(RAE-TR-71046; BR-25410) Avail: NTIS

The interrelation between a simplified wake model and the loading on a rotor blade is made. For this model the wake is treated as an infinite vortex sheet of simplified shape in quasi-steady flow and an iterative scheme is used to solve the downwash equation on the blade derived from lifting surface theory. Using this model as a basis, a comparison is made of the influence of some near-wake assumptions on the lifting characteristics of a rotor blade. In particular, the treatment of sweep effects and the vortex lattice approximation for vorticity are studied. Based on the latter comparisons, a scheme is proposed whereby the near-wake model studied could be used to improve the wake representation for a complete rotor performance computer program. Author (ESRO)

N72-15819 Defence Research Establishment Suffield, Ralston (Alberta).
DRAG ON FREE FLIGHT CYLINDERS IN A BLAST WAVE
Stanley B. Mellsen *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 83-99 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N72-14997*# Battelle Memorial Inst., Columbus, Ohio.
A PROPOSED CRITERION FOR AIRCRAFT FLIGHT IN TURBULENCE
Richard F. Porter and Alfred C. Robinson [1971] 63 p refs
(Contract NASw-2063)
(NASA-CR-124834) Avail: NTIS CSCL 01B

A proposed criterion for aircraft flight in turbulent conditions is presented. Subjects discussed are: (1) the problem of flight safety in turbulence, (2) new criterion for turbulence flight where existing ones seem adequate, and (3) computational problems associated with new criterion. Primary emphasis is placed on catastrophic occurrences in subsonic cruise with the aircraft under automatic control. A Monte Carlo simulation is used in the formulation and evaluation of probabilities of survival of an encounter with turbulence. Author

N72-14998*# North American Aviation, Inc., Los Angeles, Calif.
XB-70 AERODYNAMIC, GEOMETRIC, MASS, AND SYMMETRIC STRUCTURAL MODE DATA
John H. Wykes and Alva S. Mori Mar. 1970 93 p refs
(Contract NAS4-1580)
(NASA-CR-116773; NA-70-158) Avail: NTIS CSCL 01B

XB-70-1 mass, structural, and aerodynamic data were updated to reflect as closely as possible the characteristics of the airplane at three specific flight conditions which were actually flown. A nominal Mach number of 0.90 at an altitude of 25,000 feet (two cases), a nominal Mach number of 1.6 at an altitude of 40,000 feet (one case) were used. In-flight response characteristics at a number of points on the vehicle were obtained by exciting a pair of shaker vanes on the nose of the airplane. Data were recorded with the basic stability augmentation system (SAS) operating both alone and together with the identical location of accelerometer and force (ILAF) structural mode control system. Detailed total vehicle weight, mass characteristics, structural frequencies, generalized masses, all aerodynamic data used in the present analyses, and a description of the actual mode shapes are tabulated and presented. Author

N72-14999*# Systems Technology, Inc., Hawthorne, Calif.
MOTION EFFECTS ON AN IFR HOVERING TASK: ANALYTICAL PREDICTIONS AND EXPERIMENTAL RESULTS
R. F. Ringland, R. L. Stapleford, and R. E. Magdaleno Washington NASA Nov. 1971 203 p refs
(Contract NAS2-5261)
(NASA-CR-1933) Avail: NTIS CSCL 01B

An analytical pilot model incorporating the effects of motion cues and display scanning and sampling is tested by comparing predictions against experimental results on a moving base simulator. The simulated task is that of precision hovering of a VTOL having varying amounts of rate damping, and using separated instrument displays. Motion cue effects are investigated by running the experiment under fixed and moving base conditions, the latter in two modes; full motion, and angular motion only. Display scanning behavior is measured on some of the runs. The results of the program show that performance is best with angular motion only, most probably because a g-vector tilt cue is available to the pilot in this motion condition. This provides an attitude indication even when not visually fixating the attitude display. Vestibular threshold effects are also present

in the results because of the display scaling used to permit hovering position control within the motion simulator limits; no washouts are used in the simulator drive signals. The IFR nature of the task results in large decrements in pilot opinion and performance relative to VFR conditions because of the scanning workload. Measurements of scanning behavior are sensitive to motion conditions and show more attention to attitude control under fixed base conditions. Author

N72-15000*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATIC LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF CLOSE-COUPLED WING-CANARD CONFIGURATIONS AT MACH NUMBERS FROM 1.60 TO 2.86
Samuel M. Dollyhigh Washington Dec. 1971 116 p refs
(NASA-TN-D-6597; L-7962) Avail: NTIS CSCL 01B

An experimental investigation was made in the Mach number range from 1.60 to 2.86 to determine the static longitudinal aerodynamic characteristics of close-coupled wing-canard configurations. Three canards, ranging in exposed planform area from 17.5 to 30.0 percent of the wing reference area, were employed in this investigation. The canards were either located in the plane of the wing or in a position 18.5 percent of the wing mean geometric chord above the wing plane. Most data obtained were for a model with a 60 deg leading-edge-sweep wing; however, a small amount of data were obtained for a 44 deg leading-edge-sweep wing. The model utilized two balances to isolate interference effects between wing and canard. In general, it was determined that at angle of attack for all configurations investigated with the canard in the plane of the wing an unfavorable interference exists which causes the additional lift on the canard generated by a canard deflection to be lost on the wing due to an increased downwash at the wing from the canard. Further, this interference decreased somewhat with increasing Mach number. Raising the canard above the plane of the wing also greatly decreased the interference of the canard deflection on the wing lift. However, at Mach 2.86 the presence of the canard in the high position had a greater unfavorable interference effect at high angles of attack than the canard in the wing plane. This interference resulted in the in-plane canard having better trimmed performance at Mach 2.86 for the same center-of-gravity location. Author

N72-15001*# Mechanics Research, Inc., Los Angeles, Calif.
FUNDAMENTAL LIMITATIONS ON V/STOL TERMINAL GUIDANCE DUE TO AIRCRAFT CHARACTERISTICS
Julian Wolkovitch, Charles W. LaMont, and D. William Lochtie Washington NASA Dec. 1971 182 p refs
(Contract NAS1-9163)
(NASA-CR-1901) Avail: NTIS CSCL 01B

A review is given of limitations on approach flight paths of V/STOL aircraft, including limits on descent angle due to maximum drag/lift ratio. A method of calculating maximum drag/lift ratio of tilt-wing and deflected slipstream aircraft is presented. Derivatives and transfer functions for the CL-84 tilt-wing and X-22A tilt-duct aircraft are presented. For the unaugmented CL-84 in steep descents the transfer function relating descent angle to thrust contains a right-half plane zero. Using optimal control theory, it is shown that this zero causes a serious degradation in the accuracy with which steep flight paths can be followed in the presence of gusts. Author

N72-15002# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
STOL TECHNOLOGY BIBLIOGRAPHY UPDATE
J. H. DeLeeuw Dec. 1971 71 p refs
(UTIAS-176; CTC-RR-23) Avail: NTIS

In choosing the papers to be included in the bibliography, areas of immediate interest to Canada were covered. Most vehicle-oriented topics are concerned with the first generation of STOL transports (i.e. those with turboprop powerplants), although some papers on turbofan STOL transports are reviewed. The bibliography is fully annotated by the reviewers for quality and relevance of the contents of the papers. The outlines presented reflect the reviewers' impressions of the work and may differ considerably from the authors' abstracts. This bibliography is organized under five main headings: vehicle design and performance, operational aspects; navigation, guidance, and air traffic control; nonpassenger public acceptance, and STOLports. There are 130 entries in the update. Author

N72-15003*# Translation Consultants, Ltd., Arlington, Va.
THE VTOL JET FOR A FUTURE V/STOL TRANSPORT SYSTEM
B. Huinink and K. B. Brink Washington NASA Jan. 1972 23 p refs Transl. into ENGLISH from proc. of DKLR Symp., Hamburg, 29 Jan. 1970, p 7-32
(Contract NASw-2038)
(NASA-TT-F-14076) Avail: NTIS CSCL 01B

The prerequisites for realization and successful operation of commercial transportation systems using vertical takeoff aircraft are discussed. The aerodynamic characteristics of the Dornier 31 aircraft are described. The application of the DO-31 aircraft to meet the requirements for successful VTOL operations on a commercial basis is examined. P.N.F.

N72-15004*# Allied Research Associates, Inc., Concord, Mass.
SOME ANALYSES OF THE VARIABILITY OF ATMOSPHERIC PARAMETERS AT LOW ALTITUDES SIGNIFICANT FOR AIRCRAFT PROPAGATION
David T. Chang Washington NASA Jan. 1972 72 p refs
(Contract NAS1-9837)
(NASA-CR-1945; Rept-9G77-F) Avail: NTIS CSCL 04B

The results are discussed in terms of the meteorological data acquisition procedures necessary to monitor changes in atmospheric parameters to support aircraft flyover noise measurements and aircraft noise certification programs. The data consisted primarily of sequential radiosonde ascents to approximately 5000 ft spaced some half-hour to an hour apart. The weather covered by the data sample was predominantly that of clear skies and calm-to-light surface winds associated with well established high-pressure systems. Under these restrictive weather conditions, the study shows that the largest variabilities in temperature and humidity occur during the early morning hours resulting from the effects of direct solar heating of the surface. These rapid changes apparently do not penetrate above approximately 1000 ft. In the late morning hours, the atmosphere appears to become stabilized so that net changes in temperatures and relative humidities at all levels are insignificant even in time periods exceeding three hours. By noon, however, turbulent fluctuations in surface wind and the wind speed itself increase to levels which would make the microphone recording of acoustic signals in the field difficult. Author

N72-15005# National Transportation Safety Board, Washington, D.C.
AIRCRAFT INCIDENT REPORT: NORTHWEST AIRLINES, INC., BOEING 747-151, N607US, HONOLULU, HAWAII, 13 MAY 1971
15 Dec. 1971 10 p
(NTSB-AAR-71-16; File-4-0005) Avail: NTIS

An aircraft incident caused by the failure of a jet engine on a Boeing 747 commercial aircraft during climbout after takeoff from Honolulu, Hawaii is discussed. The probable cause of the incident was the in-flight separation of the second stage turbine disk of the number three engine. An emergency landing was made at Honolulu and no injuries were sustained. Author

N72-15006# National Aviation Facilities Experimental Center, Atlantic City, N.J. Test and Evaluation Div.
INVESTIGATION OF JET TRANSPORT AIRCRAFT VORTEX SYSTEMS DESCENDING INTO AND GENERATED IN GROUND EFFECT Data Report, 27 May - 6 Jun. 1970
Leo J. Garodz Nov. 1970 164 p refs
(Proj. 504-303-03X)

Avail: NTIS

Full scale flight tests of heavy jet transport aircraft were conducted to determine the characteristics, particularly persistency, of vortex systems generated near the ground and those generated out of but descending into ground effect. The data are applied to air traffic control criteria establishing the safe lateral and longitudinal separation of aircraft taking off and landing. Emphasis is placed on airline operations at terminals with dual and/or crossing runways. Author

N72-15007# National Aviation Facilities Experimental Center, Atlantic City, N.J. Test and Evaluation Div.

INVESTIGATION OF THE RELATIVELY LONG TIME-HISTORY VORTEX CHARACTERISTICS OF THE CONVAIR CV-880 AIRPLANE IN TERMINAL AREA TYPE FLIGHT OPERATIONS Data Report, Flight test period Jul. - Aug. 1970

Leo J. Garodz Nov. 1970 612 p refs

(Proj. 504-303-03X)

Avail: NTIS HC $9.00/MF $0.95

Tests to obtain relatively long time-history characteristics of the vortex systems of a four engine jet transport aircraft in terminal area-type operations are discussed. Data obtained from the investigation are applied to air traffic control separation criteria associated with simultaneous operations of heavy jets and other aircraft from parallel runways. The major parameters for consideration were aircraft vortex flow velocities and persistency and the effect of atmospheric characteristics and ground effect on the vortex systems. Author

N72-15008# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Abteilung Schwingungen.

DIGITAL PROGRAM FOR THE CALCULATION OF FORCES, MOMENTS, AND TIME HISTORIES FOR A HELICOPTER ROTOR WITH HINGED BLADES. PART 1: LIST OF THE EQUATIONS

O. Storm 1971 159 p refs In GERMAN; ENGLISH summary

(DLR-FB-71-67; DK-533.661; DK-681.32.06) Avail: NTIS; DFVLR, Porz: 24,50 DM

The equations for the calculation of forces, moments, and time histories of motion of a helicopter in forward flight are arranged and prepared for digital computer programming. The degrees of freedom; longitudinal, lateral and normal velocities, the rolling, pitching and yawing rates, the flapping and lagging blade motions as well as variable rotor rotational velocity are considered. Author (ESRO)

N72-15009# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

INTERFERENCE OF A CRUCIFORM WING CONFIGURATION [ZUR INTERFERENZ DER KREUZFLUEGELANORDNUNG]

G. Gregoriou Bonn Bundeswehramt 1971 43 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-71-18) Avail: NTIS; Bundeswehramt: 25 DM

Based on the lifting surface theory for the yawing wing and on the method for calculating the downwash, an attempt was made to calculate the interference of a cruciform wing in the subsonic range with the aid of an iterative process. Calculations were made for several wing shapes. The results of these calculations are presented as coefficients of forces and moments or as distributions of normal forces and pitching moments. In a few cases it was possible to compare the present method with other theories. Author (ESRO)

N72-15010# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

DOWNWASH INVESTIGATIONS ON MISSILE TAILS [ABWINDUNTERSUCHUNGEN AN LEITWERKEN VON FLUGKOERPERN]

G. Gregoriou Bonn Bundeswehramt 1971 48 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-71-19) Avail: NTIS; Bundeswehramt: 25 DM

A numerical method was developed to calculate the downwash and hence the forces and moments on missile tails. This method is principally based on the linear lifting surface theory and can be applied in the compressible subsonic range at any angle of attack and bank. The results of the calculation indicate a nonlinear dependence of the average downwash angle on the angle of attack. Generally, theoretical results show good agreement with wind tunnel tests. Author (ESRO)

N72-15011# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

PRESSURE DISTRIBUTION MEASUREMENTS ON A SLENDER BODY AND TWO WING-SLENDER BODY COMBINATIONS FOR INVESTIGATION OF NONLINEAR NORMAL FORCE AND MOMENT CHARACTERISTICS [DRUCKVERTEILUNGSMESSUNGEN AN EINEM RUMPF UND ZWEI FLUEGEL-RUMPF-KOMBINATIONEN ZUR UNTERSUCHUNG NICHTLINEARER NORMALKRAFT- UND MOMENTENCHARAKTERISTIKEN]

K. Hartmann (DFVLR) and H. Barth Bonn Bundeswehramt 1971 52 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-71-24) Avail: NTIS; Bundeswehramt: 25 DM

A survey of pressure distribution measurements, on a slender body and two wing-body combinations, is made to determine nonlinear normal forces and moments at Mach numbers from 0.7 to 1.2 and angles of attack up to 30 degrees. The normal force distributions on the isolated body and the differences of the normal forces on the afterbody, between isolated body and wing-body combination, are evaluated by integration of the pressure distribution. Author (ESRO)

N72-15012# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.

PARAFOIL FLIGHT PERFORMANCE Final Report, Apr. 1968 - Apr. 1971

John D. Nicolaides and Michael A. Tragarz Wright-Patterson AFB Ohio AFFDL Jun. 1971 73 p refs

(Contract F33615-68-C-1459; AF Proj. 6065)

(AD-731143; AFFDL-TR-71-38) Avail: NTIS CSCL 01/3

The steady state flight performance of the Parafoil is computed by using aerodynamic coefficient data obtained from wind tunnel tests of both small scale models and full scale aspect ratio 2.0 units. The actual free flight performance of the Parafoil is obtained from both manned ascending flights and manned jumps from aircraft. Attention is also given to the flight stability and control of the Parafoil and to its unique landing flare. The agreement between the performance predictions based on the wind tunnel data and the results obtained from actual flight tests is presented. The performance of a more advanced aspect ratio 3.0 Parafoil design is considered. Author (GRA)

N72-15013# Naval Missile Center, Point Mugu, Calif.

UTILITY OF THE VERTICAL CONTACT ANALOG DISPLAY FOR CARRIER LANDINGS: A DIAGNOSTIC EVALUATION

K. D. Cross and F. R. Cavaliero 20 Sep. 1971 79 p refs

(ONR Proj. Order 0-0077; ONR Proj. Order 0-0078; ONR Proj. Order 0-0079)

(AD-730464; NMC-TP-71-52; JANAIR-701212;) Avail: NTIS CSCL 01/4

The report describes an experiment designed to provide a diagnostic evaluation of the VCAD (vertical contact analog display) within a carrier-landing context. The design provided both an estimate of error associated with the performance of a carrier landing under full-scale simulation conditions with the VCAD and a means for partitioning this error into components due to: display resolution, temporal loading, and control complexity. Subjects were trained to an asymptotic level on each of five experimental conditions and their asymptotic performance

(attitude and position errors) compared across conditions. The results showed that roll, pitch, and heading deviations could be detected to an accuracy of 0.5 degree on the VCAD and that attitude control, in general, was unaffected by Temporal Loading.
GRA

N72-15014# School of Aerospace Medicine, Brooks AFB, Tex.
NOISE ASSOCIATED WITH T-41A AND T-41C TRAINER AIRCRAFT Final Report, Nov. 1970 - May 1971
Donald C. Gasaway Aug. 1971 24 p refs
(AF Proj. 7755)
(AD-731128; SAM-TR-71-22) Avail: NTIS CSCL 20/1

Acoustic noise measurements were obtained within Cessna T-41A and T-41C trainer aircraft during various phases of ground and airborne operation. Factors contributing to speech interference and auditory risk were identified, and recommendations are provided relative to improving voice communications and reducing auditory risks. Ambient noise within the T-41A and T-41C interferes significantly with speech, but this problem can be reduced when earplugs, such as the V-51R, are worn. The attenuation provided by the V51R earplugs should prevent temporary or permanent noise-induced hearing loss.
Author (GRA)

N72-15015# Wyle Labs., Inc., Hampton, Va.
PROPELLER NOISE AT LOW TIP SPEEDS Final Report, Nov. 1969 - Mar. 1971
David Brown and John B. Ollerhead Wright-Patterson AFB, Ohio AFAPL Sep. 1971 212 p refs
(Contract F33615-70-C-1135; AF Proj. 3066; Proj. 9356)
(AD-731156; WR-71-9; AFAPL-TR-71-55) Avail: NTIS CSCL 20/1

The study comprises an analytical and experimental investigation of the vortex noise generated by low-tip speed propellers. Initally, the treatment of the subject is focussed on an examination of the origins of broadband noise and the methods by which these can be analytically represented. Subsequent noise measurements on simple-design propellers indicate how the typical spectra in the Strouhal frequency range are significantly influenced by an extensive range of high order harmonics of the blade passage frequency, and a treatment of this harmonic content is included in this study report. The broadband and harmonic components of noise data, obtained from propellers with blade number and blade angle variations, have been analyzed in detail and noise prediction methods have been derived for each. It is postulated that the noise source mechanisms may be associated with unstable laminar flow separation (or transition) at the blade surfaces. The report also includes a set of graphical procedures by which both harmonic and random spectral details of the radiated noise can be calculated by tip Mach numbers in the range 0.2 to 0.6.
Author (GRA)

N72-15016# School of Aerospace Medicine, Brooks AFB, Tex. Clinical Sciences Div.
NOISE WITHIN THE F-4E DURING GROUND AND AIRBORNE OPERATIONS Final Report, Oct. 1969 - Dec. 1970
Donald C. Gasaway May 1971 19 p refs
(AF Proj. 7755)
(AD-731092; SAM-TR-71-14) Avail: NTIS CSCL 20/1

Noise levels encountered within the front and rear cockpits of the F-4E (McDonnell-Douglas) were obtained during ground and airborne operations. The acoustic features of the noise environment, as well as features of auditory risk and voiced communications, are discussed.
Author (GRA)

N72-15017# Naval Ordnance Lab., White Oak, Md.
EFFECTS OF CANOPY GEOMETRY ON THE DRAG COEFFICIENT OF A CROSS PARACHUTE IN THE FULLY OPEN AND REEFED CONDITIONS FOR A W/L RATIO OF 0.264
William P. Ludtke 20 Aug. 1971 68 p ref
(AD-731023; NOLTR-71-111) Avail: NTIS CSCL 01/3

The report describes a series of wind-tunnel tests on the cross-type parachute. The effects of cloth permeability, number of suspension lines, and suspension line length were investigated. Forty-inch-diameter models with a canopy arm width-to-length ratio (W/L) of 0.264 were tested at various velocities from 50 fps to 300 fps in the fully inflated state. Results of these tests demonstrate that the parachute geometry does have an effect on the drag capability of the cross parachute. Additional tests of reefed configurations for several reefing line lengths-to-canopy-diameter ratios from 0.45 to 1.6 at a constant velocity of 275 fps established the reefed characteristics of this parachute. Data are presented in tabular and graphical format. Photographs of representative canopy shapes are included for illustration.
Author (GRA)

N72-15018# Army Cold Regions Research and Engineering Lab., Hanover, N.H. Experimental Engineering Div.
SURFACE EFFECT VEHICLE ENGINEERING TEST PROCEDURES
Ronald Liston Aug. 1971 27 p
(ARPA Order 1615)
(AD-731214; CRREL-SR-161) Avail: NTIS CSCL 01/3

The objective of the test program was to identify the performance parameters that would establish the effectiveness of a surface effect vehicle and to design test procedures which would measure these parameters.
Author (GRA)

N72-15019# Honeywell, Inc., St. Paul, Minn. Research Dept.
CONCEPTUAL STUDY TO APPLY ADVANCED FLIGHT CONTROL TECHNOLOGY TO THE COIN OR TRIM AIRCRAFT Final Report, 1 Jul. 1970 - 3 Feb. 1971
G. A. Smith, J. M. Hammer, and R. E. Rose Jun. 1971 156 p refs
(Contract N00019-70-C-0349)
(AD-730571; Rept-12225-FR(R)) Avail: NTIS CSCL 01/3

Investigations of the Variable Deflection Thruster (VDT) for a non-external-moving surfaces (NEMS) flight control system have been extended to determine the effects of finite aspect ratio and part-span blowing at subsonic speeds. Wind tunnel tests have revealed that full-span blowing is more effective than part-span blowing for obtaining lift or rolling moments. It was also shown that the lift effectiveness decreases when the ratio of blown area to wing area decreases or when a part-span blown area is moved toward the wing tip. The results of the wind tunnel study indicate that available theoretical analyses provide satisfactory predictions of jet-flap lift for full span blowing, but further theoretical work is needed, especially to determine the effects of part-span blowing. A study to examine the feasibility of using VDT blowing for primary flight control of COIN (counterinsurgency) or TRIM (trails, roads and interdiction missions) aircraft was undertaken. The estimates of the required thrust, mass flow and horsepower seemed reasonable, so duct losses were calculated, and the weight and fuel requirements were estimated. A VDT primary flight control system weighing 480 lb was hypothesized, and the maneuvering capability of an aircraft with this NEMS system was compared to the aircraft with conventional controls. It was found that the aircraft performance was generally improved with the NEMS control system.
Author (GRA)

N72-15020# Wyle Labs., Inc., Rockville, Md. Payne Div.
AN OPTIMUM ACCELERATION TIME HISTORY FOR AN ESCAPE SYSTEM Report for Jun. 1967 - Feb. 1968
Peter R. Payne and David A. Shaffer Wright-Patterson AFB, Ohio AMRL Aug. 1971 24 p refs
(Contract F33615-67-C-1807; Task-7231-01)
(AD-731194; Working-Paper-140-2; AMRL-TR-70-143) Avail: NTIS CSCL 01/3

Large accelerations must be imposed upon an escape system in order for this system to rapidly leave the cockpit and safely clear the aircraft empennage. An upper bound to this

acceleration-time history is imposed by the physiological limitations of the escape system occupant. The report contributes to the search for an optimum acceleration-time history which will, for a given physiological stress level, minimize the escape time and maximize the escape velocity. The authors conclude that an impulsive velocity spike, followed by a zero rise time constant acceleration, will give a 70% reduction in escape time, relative to present systems. Although this velocity profile is not shown to be the mathematically optimum form of excitation, it is the best of those investigated. Author (GRA)

N72-15831 Southwest Research Inst., San Antonio, Tex.
METHODS OF COMPUTING STRUCTURAL RESPONSE OF HELICOPTERS TO WEAPONS' MUZZLE AND BREECH BLAST
W. E. Baker, S. Silverman, P. A. Cox, Jr., and D. Young *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 227-241 refs Sponsored by Army Ballistics Res. Labs. (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-15837 Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
THE SHOCK AND VIBRATION EXPERIENCED BY NAVAL AVIONICS DURING ARRESTED LANDING
Vaughn M. Foxwell, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 37-59 (See N72-15833 06-32)
Avail: NTIS Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators, and inverters. For related information see also 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N72-15021*# Gulton Industries, Inc., Metuchen, N.J. Battery and Power Sources Div.
LARGE SILVER-CADMIUM TECHNOLOGY PROGRAM
S. Charlip and S. Lerner Jul. 1971 104 p ref
(NAS3-13233)
(NASA-CR-120845; FO-24480) Avail: NTIS CSCL 10C

The effects of varying cell design on operation factors on the electrochemical performance of sealed, silver-cadmium cells were determined. A factorial experiment was conducted for all test cells constructed with organic separators. Three operating factors were evaluated: temperature, depth of discharge, and charge rate. The six construction factors considered were separator, absorber, electrolyte quantity, cadmium electrode type, cadmium-to-silver ratio, and auxiliary electrode. Test cells of 4 ampere-hour capacity were fabricated and cycled. The best performing cells, on a 94 minute orbit, at 40% depth of discharge, were those containing silver-treated fibrous sausage casings as the separator, and Teflon-ated, pressed cadmium electrodes. Cycling data of cells with inorganic separators (Astroset) are given. Best performance was shown by cells with nonwoven nylon absorbers. Rigid inorganic separators provided the best barrier to silver migration. Author

N72-15022*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL DESIGN OF A PARASITIC-LOADING DIGITAL SPEED CONTROLLER FOR A 400-HERTZ TURBINE DRIVEN ALTERNATOR
Bill D. Ingle and John P. Ryan Washington Jan. 1972 48 p refs
(NASA-TN-D-6590; E-6430) Avail: NTIS CSCL 10A

A design for a solid-state parasitic speed controller using digital logic was analyzed. Parasitic speed controllers are used in space power electrical generating systems to control the speed of turbine-driven alternators within specified limits. The analysis included the performance characteristics of the speed controller and the generation of timing functions. The speed controller using digital logic applies step loads to the alternator. The step loads conduct for a full half wave starting at either zero or 180 electrical degrees. Author

N72-15023*# Pratt and Whitney Aircraft, East Hartford, Conn.
PC8B-4-X562 FUEL CELL ELECTRICAL POWER SUPPLY, OPERATIONS MANUAL
2 Jul. 1970 45 p
(Contract NAS9-10368)
(NASA-CR-115304; PWA-3975) Avail: NTIS CSCL 10A

The PC8B-4 fuel cell electrical power supply is an electrical powerplant designed to convert the chemical reaction of hydrogen and oxygen into electrical energy. It utilizes catalyzed electrodes with a potassium hydroxide electrolyte. The powerplant and test stand control unit are described together with a specifications summary. Separate sections deal with: performance, reactants supply and control, heat removal, water removal instrumentation, operation, and safety considerations. D.L.G.

N72-15024*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN OF A THREE-PHASE, 15-KILOVOLT-AMPERE STATIC INVERTER FOR MOTOR-STARTING A BRAYTON SPACE POWER SYSTEM
Robert J. Frye and Arthur G. Birchenough Washington Feb. 1971 22 p refs
(NASA-TN-D-6602; E-6622) Avail: NTIS CSCL 10A

The design of a three-phase, 400-Hz, 15-kVA static inverter for motor-starting the 2- to 15-kWe Brayton electrical space power system is described. The inverter operates from a nominal 56-V dc source to provide a 28-V, rms, quasi-square-wave output. The inverter is capable of supplying a 200-A peak current. Integrated circuitry is used to generate the three-phase, 400-Hz reference signals. Performance data for a drive stage that improves switching speed and provides efficient operation over a range of output current and drive supply voltage are presented. A transformerless, transistor output stage is used. Author

N72-15025# Naval Ordnance Lab., White Oak, Md.
DEVELOPMENT OF LONG LIFE ZINC-OXYGEN CELLS
Richard D. Weller 30 Jun. 1971 47 p refs
(ORD Proj. 531-215)
(AD-731029; NOLTR-71-81) Avail: NTIS CSCL 10/3

The feasibility of using zinc-oxygen batteries for long-term discharges was investigated with the objective of attaining a one-year discharge lifetime and a five-year storage lifetime at uncontrolled temperatures. Zinc and oxygen electrodes were developed and used to construct zinc-oxygen cells for discharge testing. Cell lifetime was limited by premature oxidation of the zinc electrode due to corrosive chemical reactions set up by the nickel. The five-year storage requirement dictates the use of a reserve configuration with electrolyte kept in individual cell reservoirs during storage. Preliminary designs of the electrolyte storage and activation systems were done based on the electrode and cell designs developed. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N72-15026*# Avco-Everett Research Lab., Everett, Mass.
THE FLUID MECHANICS OF THROMBUS FORMATION
Washington NASA Jan. 1972 65 p refs
(Contract NASw-1894)
(NASA-CR-1938) Avail: NTIS CSCL 06P

Experimental data are presented for the growth of thrombi (blood clots) in a stagnation point flow of fresh blood. Thrombus shape, size and structure are shown to depend on local flow conditions. The evolution of a thrombus is described in terms of a physical model that includes platelet diffusion, a platelet aggregation mechanism, and diffusion and convection of the chemical species responsible for aggregation. Diffusion-controlled and convection-controlled regimes are defined by flow parameters and thrombus location, and the characteristic growth pattern in each regime is explained. Quantitative comparisons with an approximate theoretical model are presented, and a more general model is formulated. Author

N72-15027*# Scientific Translation Service, Santa Barbara, Calif.
EXAMINATIONS FOR DETERMINING MUSCLE ATROPHY THRESHOLD
Th. Hettinger Washington NASA Dec. 1971 8 p refs Translation into ENGLISH from Intern. Z. Angew. Physiol. (W. Berlin), V. 16, 1955 p 52-56
(Contract NASw-2035)
(NASA-TT-F-14094) Avail: NTIS CSCL 06P

The atrophy threshold in human arm muscles was determined experimentally with six subjects. The arms were held in plaster casts for several days in several positions except during stress periods. Forces in the arm muscles were measured, and atrophy determined. Author

N72-15028*# Scripta Technica, Inc., Washington, D.C.
PROBLEMS OF PHYSIOLOGICAL OPTICS. VOLUME 15: PHYSIOLOGY OF VISION UNDER NORMAL AND EXTREMAL CONDITIONS
V. G. Samsonova, A. I. Bogoslovskiy, V. D. Glezer, V. V. Meshkov, and Ye. N. Semenovskaya, eds. NASA Nov. 1971 222 p refs Transl. into ENGLISH of the book "Problemy Fiziologicheskoy Optiki, Tom 15: Fiziologiya Zreniya Normal'nykh i Ekstremal'nykh Usloviyakh" Acad. of Sci. USSR, Nauka Press, Leningrad, 1969
(Contract NASw-2036)
(NASA-TT-F-650) Avail: NTIS CSCL 06P

Physiological factors of human vision and the simulation of visual systems are discussed. Electrophysiological and optical research methods are used to study normal as well as extremal visual conditions. For individual titles, see N72-15029 through N72-15064.

N72-15029*# Scripta Technica, Inc., Washington, D.C.
COURSE OF DEVELOPMENT OF THE PHYSIOLOGY OF VISION AND OF PHYSIOLOGICAL OPTICS IN THE USSR OVER THE LAST 50 YEARS
V. G. Samsonova *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 1-5 Presented at the 5th Conf. on Physiol. Optics, 27 Oct. 1966 (See N72-15028 06-04)
Avail: NTIS CSCL 06P

The history of the science of physiology of vision in the Soviet Union is reviewed. Author

N72-15030*# Scripta Technica, Inc., Washington, D.C.
SIMULATION OF THE COLOR VISION PROCESS IN MAN
D. A. Shklover *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 6-18 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

A mathematical model for the human color vision process where the output signals correspond to experimental functions obtained under specific observational conditions is reported. The model is used to explain several characteristic features of the color vision system in man. An electronic analog is outlined which reproduces the main functions of the system and which can be used to develop photoelectric methods of color measurement. The electronic analog is applied to problems involving the color resolution of the eye under different circumstances. Author

N72-15031*# Scripta Technica, Inc., Washington, D.C.
CERTAIN PSYCHOPHYSIOLOGICAL PRINCIPLES OF COLOR PERCEPTION DESCRIBED BY A NONLINEAR MODEL
A. V. Matveyev *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 19-27 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

A mathematical model of human vision based on the spectral sensitivity curves of three color-sensitive receivers (green, red, and blue) is formulated. Analysis of the model's equations shows that the curves for the dependence of perception on color are more linear for the red and green receivers than for the blue receiver. All achromatic tints are positioned along a hyperbola in perception space, bending toward the axis of the blue receiver. Author

N72-15032*# Scripta Technica, Inc., Washington, D.C.
DEDUCTIVE CONSTRUCTION OF A MODEL FOR THE LOWER METRIC OF COLOR
Yu. P. Shabanov-Kushnarenko *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 28-31 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

A new formulation of Grassman's laws is presented in which the operation of color composition is not used and in which the logical equivalence of a model of vision statics to Grassman's laws as newly formulated is proven. Author

N72-15033*# Scripta Technica, Inc., Washington, D.C.
OPERATOR ANALYSIS OF ELECTRORETINOGRAMS
D. S. Melkonyan and L. G. Barsegyan *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 32-42 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

It is shown that within certain frequency and illumination ranges, the light stimulus and the resulting potential are related by a function that can be described by a linear stationary operator, which is derived from an experimentally-determined APFC function. Author

N72-15034*# Scripta Technica, Inc., Washington, D.C.
POSSIBLE FORMS OF COLOR VISION
N. V. Lobanova *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 43-47 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

The spectral sensitivities of twelve normal and deuteronomalous trichromats, as well as one protanomalous and one tritanomalous trichromat are described. Author

N72-15035*# Scripta Technica, Inc., Washington, D.C.
METHODS OF SPECTRAL INDICATION
Ye. B. Rabkin *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 48-53 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

Schematic curves of saturation, visibility, electrical sensitivity, adisparopia, functional stability and color fatigue in the spectrum

of normal trichromats are plotted. The indicated regularities in the features of the medium-wave portions of the spectrum and the reactions of the optical analyzer in the process of adaptation to them serve as a basis for the spectral equation. Author

N72-15036*# Scripta Technica, Inc., Washington, D.C.
LIGHT AND COLOR THRESHOLDS OF LIGHTS AGAINST A BACKGROUND OF DIFFERENT BRIGHTNESS c23
R. L. Folb and S. V. Voronina *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 54-60 refs (See N72-15028 06-04)
Avail: NTIS CSCL 20F

Data are presented that make it possible to calculate the intensity of constant and flashing colored signal lights used at night against a background of low brightness. Author

N72-15037*# Scripta Technica, Inc., Washington, D.C.
COLOR DISCRIMINATION IN PERSONS WITH LOW VISUAL ACUITY
A. I. Kaplan *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 61-64 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

Color discrimination was investigated in 230 children of school and preschool age with visual acuity either below 0.05 or equivalent to light perception only. Contrary to some data in the literature, normal color discrimination was found in children with a visual acuity below 0.05. In some subjects, different types of pathology of color discrimination were observed. Ye. B. Rabkin's charts can be used if the visual acuity is below 0.02. Author

N72-15038*# Scripta Technica, Inc., Washington, D.C.
MICROINTERVAL ANALYSIS OF THE DEVELOPMENT OF VISUAL PERCEPTION
P. O. Makarov *In its* Probl. of Physiol. Optics, Vol 15 Nov. 1971 p 65-69 (See N72-15028 06-04)
Avail: NTIS CSCL 06P

Results of a microinterval analysis show a regular phased development of human visual color perception. The stages involved consist of preperception, achromatic perception, and chromatic perception. This pattern is evident in color discrimination in the presence of two stimuli. When two short stimuli (initially red and then green) sequentially affect the same retinal region, then the intensification of one (green) masks the appearance of the other weaker (red) stimulus. Author

N72-15039*# Scripta Technica, Inc., Washington, D.C.
INVESTIGATION OF THE CRITICAL DISCRETENESS INTERVAL OF THE VISUAL SYSTEM
L. P. Grigoryeva and Ye. N. Sokolov *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 70-79 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

The critical discreteness interval, i.e., the minimum time interval in which it is still possible to discriminate successive visual stimuli was analyzed. Studies involved the dependence of the interval on the location of the stimulus in the field of view, flare brightness, and conditions of adaptation. Significant shortening of the interval is demonstrated with increasing density of the receptor nerve elements of the retina, with increasing intensity of the afferent signal, and with rhythmic stimulation of the visual system. Author

N72-15040*# Scripta Technica, Inc., Washington, D.C.
THE RETINA AS AN INDICATOR OF CORTICAL INDUCTION PHASES
P. G. Snyakin and A. P. Anisimova *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 80-84 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

Results of a study of positive and negative cortical induction as estimated by the retinal mobility index are reported. It is shown that retinal mobility is a good indication of induction intensity and can be used to express the activity of the acoustic, olfactory, and cutaneous analyzers. Retinal reactions reflect the formation of human conditioned reflexes as well as the phases of positive and negative induction between the sensory centers. Author

N72-15041*# Scripta Technica, Inc., Washington, D.C.
TIME OF VISUAL PERCEPTION UNDER THE ACTION OF THERAPEUTIC X-RAY DOSES ON THE DIENCEPHALO-HYPOPHYSIAL REGION
G. I. Nemtseyev and N. S. Kharon *In its* Probl. of Physiol. Optics, Vol 15, Nov. 1971 p 85-90 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

The visual perception time in 26 patients subjected to X-ray treatment of the diencephalic region was studied. Seventeen patients suffered endocrine exophthalmos and nine optochiasmal arachnoiditis with disturbed visual function. After irradiation all subjects exhibited reduced visual perception time, which is interpreted as resulting from a reduced excitibility threshold of the interneuronal synapses of the visual tract. Author

N72-15042*# Scripta Technica, Inc., Washington, D.C.
FUNCTIONAL EFFICIENCY OF THE VISUAL ANALYSOR DURING WORK WITH MICROSCOPES c05
N. I. Zoz *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 91-94 refs (See N72-15028 06-04)
Avail: NTIS CSCL 05E

Working conditions and the functional efficiency of the visual analyzer were investigated in workers making semiconductor instruments in which several operations were performed with the aid of microscopes. Time and motion studies of the work process, investigations of the stability of color discrimination, visibility, and visual efficiency showed that the assembly of semiconductor instruments caused changes in the tested functions, and these changes increased throughout the working day. The quality of the lighting at such factories was reviewed and some recommendations were given for its improvement. Author

N72-15043*# Scripta Technica, Inc., Washington, D.C.
SHORT LATENCY PROCESSES IN THE VISUAL SYSTEM OF CATS
I. A. Shevelev *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 95-98 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06C

Early changes preceding the development of the initial afferent flow were studied at all levels of the visual system of anesthetized cats on the basis of integral slow potentials. Responses of very short latency were found in the ganglionic layer of the retina and at higher levels of the visual system, indicating the existence of a system of cells and fibers transmitting stimuli with very short delays. On the basis of similarity between the recovery cycle of cortical responses to electrical stimulation of the optic nerve and cortical prepotentials, it is postulated that the latter are the result of changes in excitability of a small group of units with the shortest latency after their synchronized firing. Author

N72-15044*# Scripta Technica, Inc., Washington, D.C.
RECRUITING OF NEURONS OF THE RABBIT SUPERIOR COLLICULI IN RESPONSES
N. V. Dubrovinskaya *In its* Probl. of Physiol. Optics, Vol 15 Nov. 1971 p 99-104 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06C

Unit activity in the superior colliculi in response to single, paired, and repetitive photic stimuli was studied in waking rabbits by means of an extracellular tungsten microelectrode. Inhibition developed in 69 percent of units responding to a single flash. During rhythmic stimulation, the neurons differed in their lability. Prolonged rhythmic action is the condition of labilization of these units. Author

N72-15045*# Scripta Technica, Inc., Washington, D.C.
INFLUENCE OF PROLONGED PHOTIC AND ACOUSTIC STIMULI ON UNIT ACTIVITY IN THE LATERAL GENICULATE BODY OF RABBITS
T. G. Beteleva *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 105-112 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06C

Using tungsten microelectrodes, the activity of 11 units the lateral geniculate body was studied in waking rabbits during exposure to flashes at 80 Hz and clicks at 15-95 Hz. The duration of repetitive stimulation and of the intervals between stimuli was 5 min. In six of the eleven neurons this stimulation produced a lasting change in spontaneous activity, either an increase or decrease in its frequency, which is interpretated as a tonic change in unit activity of the lateral geniculate body.
Author

N72-15046*# Scripta Technica, Inc., Washington, D.C.
HYPOTHALAMIC POTENTIALS EVOKED BY PHOTIC STIMULATION OF THE RETINA
A. S. Novokhatskiy *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 113-119 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06C

Direct anatomical couplings between the retina and hypothalamus via centripetal and centrifugal fibers are demonstrated in study of light-evoked potentials in various parts of the hypothalamus of 32 rabbits tested simultaneously. These evoked potentials were found to have a multicomponent structure and were observed most often in the evoked response from the supraoptic, periventricular, and mamillary nuclei. Comparison of the latencies of the electroretinography and evoked responses in the hypothalamus showed that the latency of the anterior nuclei of the hypothalamus often coincides with that of the ERG, while in the mamillary nucleus it averages 10 msec greater, and in the posterior portion is somewhat shorter. Author

N72-15047*# Scripta Technica, Inc., Washington, D.C.
LIGHT EVOKED POTENTIALS IN HEALTHY PERSONS AND IN PATIENTS WITH PATHOLOGICAL LESIONS IN VARIOUS PARTS OF THE VISUAL SYSTEM
Ye. N. Semenovskaya, A. I. Bogoslovskiy, and V. K. Zhdanov *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 120-130 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

Data relating to the site, character, and degree of the pathological focus at different levels of the visual system are compared with the results of a combined electrophysiological investigation of the organ of vision (based on evoked potentials and the electroretinogram). Patients with a pathological state of the optic nerve, with various diseases of the retina, with diencephalic disturbances of regulation of the intraocular pressure, and with glaucoma and amblyopia were investigated. It is shown that a careful study of cortical evoked potentials, together with the use of combined electrophysiological methods, can substantially facilitate the determination of the character and location of a lesion in the organ of vision. Author

N72-15048*# Scripta Technica, Inc., Washington, D.C.
PHOTOREACTIVITY OF THE PIGMENTED EPITHELIUM OF THE EYE
M. A. Ostrovskiy *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 131-135 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

Detection of free radicals in the pigmented epithelium and in a suspension of its melanoprotein granules when acted upon by visible light of physiological intensities is reported. When the light is switched off, the free radicals recombine and disappear, thus distinctly manifesting a reversibility effect - namely, the appearance and disappearance of radicals during repeated switching on and off of the light. The photoreactivity of the pigmented epithelium thus shown and certain features of the metabolism and structure of its cells and processes suggest that the pigmented epithelium may play a more significant physiological role in the regulation and realization of the photoreceptor act in the retinal cells than has hitherto been assumed. Author

N72-15049*# Scripta Technica, Inc., Washington, D.C.
NEW DATA ON THE MECHANISMS OF ACTION OF IONIZING RADIATION ON FUNCTIONAL PROPERTIES OF THE RETINA
G. G. Demirchoglyan *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 136-140 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

The effect of ionizing radiation on the frog retina was studied by recording ERGs from an isolated retina bathed in a nutrient fluid. During the action of the ionizing radiation the b-wave of the ERG was reduced. X-ray stimulation with an intensity of 5 R/sec and a duration of 1 sec evoked a response which was similar to the ERG of a retina exposed to a light stimulus of 0.05 lux of the same duration. Author

N72-15050*# Scripta Technica, Inc., Washington, D.C.
BASIC PROBLEMS OF THE PHYSIOLOGY OF THE VISUAL ANALYZER UNDER EXTREMAL CONDITIONS
Yu. P. Petrov *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 141-147 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

A survey of the literature on studies of disturbances of visual functions due to action of certain extremal factors is reported. The effects of changes in gravitational conditions, changes in atmospheric pressure and gas composition, mechanical vibrations, and electromagnetic waves of various spectral ranges leading to disturbances such as contractions of the field of vision, reduction of visual acuity, impairment of color vision, hemorrhages, crystalline lens shifts, and pathological vasomotor effects are discussed. Possible mechanisms of these disturbances are suggested. Author

N72-15051*# Scripta Technica, Inc., Washington, D.C.
EFFECT OF SPACEFLIGHT FACTORS ON VISUAL FUNCTIONS
Yu. P. Petrov *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 148-152 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

Visual tasks confronting astronauts during space flight are studied, emphasizing the effect of physiological and physical factors acting at various stages of flight on the execution of these tasks. Methods by which the effects of these factors can be attenuated or by which disturbances of the visual functions can be compensated are discussed. Author

N72-15052*# Scripta Technica, Inc., Washington, D.C.
INVESTIGATION OF SPATIAL VISION OF A FLIGHT CREW
K. S. Petrov *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 153-154 (See N72-15028 06-04)
Avail: NTIS CSCL 06P

An estimation of the absolute distance perception of 100 pilots and navigators with emmetropic refraction and flight experience ranging from 5 to 25 years is given. The threshold values of absolute distance perception of the subjects are found to lie in the range from 10 to 12 m. It is suggested that this range be taken as the norm for spatial vision of a flight crew.
Author

N72-15053*# Scripta Technica, Inc., Washington, D.C.
STUDY OF ACHROMATIC AND CHROMATIC VISUAL SENSITIVITY DURING SHORT PERIODS OF WEIGHTLESSNESS
L. A. Kitayev-Smyk *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 155-159 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

Thirty men subjected to short periods of weightlessness preceded or followed by g forces were studied while flying in an

aircraft along a parabolic trajectory for changes in their color perception. In the case of five of the subjects the field of vision and the light sensitivity were also studied. It was found that under conditions of weightlessness there was an increase in sensitivity to yellow and, to lesser extent, to red. At the same time, in a number of cases the sensitivity to blue-violet radiation decreased. The scotopic vision threshold also decreased, while the field of vision remained unchanged. Author

N72-15054*# Scripta Technica, Inc., Washington, D.C.
ROLE OF CONVERGENCE IN DISTANCE PERCEPTION DURING THE LANDING OF AN AIRCRAFT
Yu. V. Kamenshchikov *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 160-163 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

The role of convergence in distance perception was studied for the range from 30 to 50 m in the case of 100 men with normal binocular vision, emmetropic refraction, and visual acuity. It was found that in 75 percent of the men tested convergency increased the accuracy of estimating the distance from an object from 20 to 50 percent, while in 25 percent of the subjects convergence had no effect on the threshold of absolute distance perception. Author

N72-15055*# Scripta Technica, Inc., Washington, D.C.
STUDY OF DYNAMIC VISUAL ACUITY
M. G. Kozyrkova *In its* Probl. of Physiol. Optics, Vol. 15, Nov. 1971 p 164-168 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

The visual acuity of 130 subjects ranging from 20 to 40 years of age was studied, who were required to track an object moving in a horizontal plane. It was found that for an object moving at the rate of 20 deg/sec with an observation time of 1 sec visual acuity was the same as in a stationary test. When the motion of the object was accelerated to 40 deg/sec or the observation time shortened to 0.5 sec, visual acuity was reduced by 0.1. Each subsequent 20 deg/sec increase in the rate of motion decreased visual acuity by 0.1 to 0.2. In addition, a quantitative study was made of the effects of the direction and duration of the test motion on visual acuity. Author

N72-15056*# Scripta Technica, Inc., Washington, D.C.
RESTORATION OF VISUAL ACUITY AFTER A BRIGHT LIGHT FLASH OF SHORT DURATION
V. A. Khitun, P. A. Korzun, V. I. Shostak, and Ye. A. Obukhova *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 169-171 (See N72-15028 06-04)
Avail: NTIS CSCL 06P

Results on restoration of visual acuity after exposure to flashes of various duration, shape and brightness are presented. Author

N72-15057*# Scripta Technica, Inc., Washington, D.C.
CERTAIN FEATURES OF THE EFFECT OF SHORT TERM SUPER-BRIGHT LIGHT FLASHES AGAINST A BACKGROUND OF TOTAL DARK ADAPTATION
V. I. Shostak *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 172-174 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

The restoration of light sensitivity in seven subjects exposed to flashes with brightnesses up to 7.2 x 10 to the 7th nits is studied. The electrical sensitivity of the eye, the ERG, the EEG, and the critical frequency of the disappearance of electrical phosphene are also considered. Averaged curves of dark adaptation after ten minutes of light adaptation to a globe brightness of 2500 apostilbs or after diffuse illumination by a flash with a brightness of 7 x 10 to the 7th nits for 2.1 msec are obtained, as well as curves for adaptation after illumination under conditions of shielding the central part of the retina. In the latter case the light sensitivity of the periphery is restored faster, thus attesting to the braking effect of the photopic afferent system on the scotopic system in the presence of super-bright stimuli. Author

N72-15058*# Scripta Technica, Inc., Washington, D.C.
ON THE PROBLEM OF THE REFRACTION OF THE FISH EYE
P. B. Bogatyrev *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 175-185 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

Refraction was investigated in 11 species of freshwater fishes and 9 species of exotic aquarium fishes of different ages by the anatomical-optical method with rapid freezing of the eye. Type 1 comprises those fishes in whom the center of the crystalline lens coincides with the center of the retinal hemisphere. The refraction of such eyes is of the myopic type. The eyes of fishes of type 2 are capable of adjustment for sharp vision on very near objects and on objects at considerable distances. In them refraction is different along the different optic axes and emmetropic along the central axis. The eyes of the eel and the trout are of the third type; here the zones of sharp vision are differently arranged from that in fishes of type 2, but these fishes also possess the capacity for differential focussing for the simultaneous viewing of objects at different optic angles and at different depth. Author

N72-15059*# Scripta Technica, Inc., Washington, D.C.
HISTOCHEMICAL HETEROGENEITY OF RETINAL NEURONS EXEMPLIFIED BY DISTRIBUTION OF ACID PHOSPHATASE ACTIVITY
M. A. Ostrovskiy and S. Ye. Polyak *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 186-191 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

The distribution of acid phosphatase activity in the frog retina was investigated histochemically in relation to functional differences in retinal neurons, and especially in cells of the inner nuclear layer. Deposits of lead sulfide, indicating the presence of enzyme activity, are clearly seen in the ganglion cells and in Mueller's fibers, and also in the horizontal cells of the inner nuclear layer. Practically no deposition of lead sulfide was observed in the bipolar cells of this layer or in the photoreceptors. Author

N72-15060*# Scripta Technica, Inc., Washington, D.C.
A STUDY OF THE FUNDUS OCULI IN POLARIZED LIGHT
R. M. Tamarova *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 192-199 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

A description of the operational principle of two polarization instruments, an apparatus to photograph the fundus oculi and a maculotester, an instrument for subjective investigation of the macula retinae, is given. Data obtained by means of these instruments prove existence of areas having different forms of optical anisotropy in the fundus oculi. Author

N72-15061*# Scripta Technica, Inc., Washington, D.C.
USE OF POLARIZED LIGHT TO STUDY THE ANATOMY, PHYSIOLOGY, AND PATHOLOGY OF THE FUNDUS OCULI
D. I. Mitkokh *In its* Probl. of Physiol. Optics, Vol. 15, Nov. 1971 p 200-204 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

Results of an ophthalmoscopic study of 60 patients using an apparatus with built-in polaroids to inspect and photograph the fundus oculi are given. It is found that the structure of the fundus oculi (in particular, the macula lutea) is more easily visible in polarized light, thus facilitating early diagnosis of various diseases of the optic nerve and the macula lutea. It is also noted that by varying the position of the polaroids it is possible to obtain both black-and-white and color photographs of the fundus oculi. Author

N72-15062*# Scripta Technica, Inc., Washington, D.C.
METHODS OF INVESTIGATING THE ACCOMMODATION TIME IN MAN
A. A. Sychev *In its* Probl. of Physiol. Optics, Vol. 15 Nov.

1971 p 205-208 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

A method of studying the accommodation time of the eyes during transfer of fixation from the near distance and also of determining the time of its increase and decrease after fitting optical glasses to the eyes is reported. The instrument incorporates an ordinary chronoreflectometer. The use of this method on five subjects showed that the time for de-accommodation after strengthening accommodation by 3.0 D is 0.58-0.69 sec in emmetropes and 0.95-1.11 sec in myopes. The time required for strengthening accommodation by 3.0 D in emmetropes is 1.10-1.20 sec and in myopes 1.07-1.16 sec. Author

N72-15063*# Scripta Technica, Inc., Washington, D.C.
THE METHOD OF CONSTANT PERIODS
A. I. Ivanov *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 209-215 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

This method for the determination of visual thresholds stems from the mechanism of sight itself, which reduces in the simplest cases to the temporal and spatial summation of photic stimuli on the retina and the transmission to the brain of signals in the form of discrete, more or less periodic action currents. Author

N72-15064*# Scripta Technica, Inc., Washington, D.C.
COMPARISON OF THE BINOCULAR FUNCTIONS DURING ISOMETROPIA AND ANISOMETROPIA
Yu. Z. Rozenblyum *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 216-220 refs (See N72-15028 06-04)
Avail: NTIS CSCL 06P

The depth of interruption of binocular vision depends primarily on the degree of anisometropia and on the depth of amblyopia of the poorer eye. Binocular vision is somewhat worse in hypermetropic refraction than in myopic and unlike refraction. The most informative test characterizing binocular vision in anisometropia is the determination of the relative depth of objects in stereopairs. Stereoscopic vision can occur even in the absence of binocular fusion in other tests (color test and diploscope). Author

N72-15065*# Montefiore Hospital, New York.
[SLEEP-WAKE CYCLE EFFECTS ON SLEEP STAGES, AND PLASMA CORTISOL AND GROWTH SECRETIONS]
Research Report, 15 Jun. 1970 - 30 Nov. 1971
30 Nov. 1971 12 p refs
(Contract NAS9-10819)
(NASA-CR-115342) Avail: NTIS CSCL 06S

Studies were made of the effects of various stimuli on sleep stages and of secretion of a number of different hormones during sleep in human subjects. Among the stimuli were vestibular stimulation, the action of L-Dopa, and a three-hour sleep-wake cycle. Hormones observed included plasma cortisol, growth hormone, dehydroisoandrosterone, and luteinizing hormone. Relationships between sleep onset, the presence of Cushing's syndrome or sleep disorders, and ultradian rhythmicity, and hormone secretion were investigated. Sleep patterns and hormone secretion in normal subjects were also studied. K.P.D.

N72-15066# Joint Publications Research Service, Washington, D.C.
BIOLOGICAL EFFECT OF A LASER ON THE SKIN
I. G. Lagunova, Ye. D. Savchenko, L. L. Likhovetskaya, N. N. Garvey, G. G. Shamayeva, and A. V. Klimov 14 Jan. 1972 8 p refs Transl. into ENGLISH of Med. Radiol., Moscow, Russian, no. 9, 1971 p 38-42
(JPRS-54936; UDS-615.849.19.015.4:612.79) Avail: NTIS

The effects of laser radiation on skin deterioration are investigated using rats as subjects. The rats were irradiated using a neodymium laser, operating in a free generating mode. The incident energy was approximately 100 to 120 joules with a density of 500 to 4000 joules/sq cm. Pulse duration was approximately one millisecond. After irradiation, the rats were divided into a controlled and an experimental group and observed for thirty days. Observational results show harmful tissue deterioration almost immediately after irradiation in both groups, with the control group showing the least effects. Microscopic examination revealed incorrect, distorted tissue regeneration in the animals, and that destructive changes occured in direct relation to the density of the energy applied. E.H.W.

N72-15067*# Translation Consultants, Ltd., Arlington, Va.
ON THE PROPHYLACTIC ACTION OF SALTED DRINKS DURING WORK AT HIGH TEMPERATURES. PRESENT STATE OF THE PROBLEM
L. Parmeggiani Washington NASA Jan. 1972 20 p refs Transl. into ENGLISH from Med. Lavoro (Milan), v. 49, no. 4, Apr. 1958 p 245-258
(Contract NASw-2038)
(NASA-TT-F-14050) Avail: NTIS CSCL 06H

Prophylactic use of saline beverages during work at high temperatures was empirically introduced; the effectiveness of these drinks in preventing heat cramps was demonstrated in several experiments. Afterwards it was shown that the organism has a wide capacity of metabolic adaptation during work at high temperatures through the action of the adrenal cortex, the hypophysic and other mechanisms, and the indication of saline beverages was considered mostly in connection with working efficiency. It was shown that an exceeding salt intake induces a decrease of working efficiency of at least the same intensity as that due to dehydration. The effect of saline beverages is conditioned therefore by the dietary sodium intake, but the scarce investigations on dietary habits of workers, as presently available, do not give a clear answer on the opportunity of using beverages in industries and mines. Author

N72-15068*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CYCLOTRON PRODUCTION OF I-123: AN EVALUATION OF THE NUCLEAR REACTIONS WHICH PRODUCE THIS ISOTOPE
Vincent J. Sodd (Nucl. Medicine Lab., Cincinnati, Ohio), Kenneth L. Scholz (Nucl. Medicine Lab., Cincinnati, Ohio), James W. Blue, and Henry N. Wellman (Div. of Medical Radiation Exposure, Cincinnati, Ohio) Rockville, Md. Bureau of Radiological Health Oct. 1970 45 p refs
(NASA-Tm-X-67594; BRH/DMRE-70-4) Avail: NTIS CSCL 06R

The use of the various nuclear reactions is described by which I-123,a low radiation dose radiopharmaceutical, can be cyclotron-produced. Methods of directly producing I-123 and those which indirectly produce the radionuclide through the beta (+) decay of its nautral precursor, Xe-123. It is impossible to separate from the radioiodine contaminants, notably I-124, which occur in the direct method. Thus, it is preferable to produce pure I-123 from Xe-123 which is easily separated from the radioiodines. Among the characteristics of I-123 is the capability of reducing the patient dose in a thyroid uptake measurement to a very small percentage of that delivered by the more commonly used I-131. Author

N72-15069*# AiResearch Mfg. Co., Los Angeles, Calif.
TEKTITE 2 HABITABILITY RESEARCH PROGRAM
D. P. Nowlis, E. C. Wortz, and H. Watters 14 Jan. 1972 121 p refs
(Contract NAS8-25100)
(NASA-CR-123496; Rept-71-6192-1) Avail: NTIS CSCL 06S

Multi-level parameters relating to perceived life quality in an isolated research and residence quarters were measured using a variety of tests. The habitat under study, emplaced beneath the sea off the coast of St. John's Island as a part of the Tektite II program, was being used for marine research. The crew for each of the 10 missions consisted of one engineer and 4 scientists. One mission had an all-female crew. Mission length was either

14 or 20 days, and 4 engineers, in covering 6 missions, stayed in the habitat for periods of 30 days each. A personality test was taken before confinement in the habitat. Two attitude tests were filled out by the aquanauts while they were still in the habitat. Daily moods were monitored during all missions. Special observations were made of leisure time use. Standardized private debriefings were administered at the end of each mission to each aquanaut. Other behavioral observations made by another research team were intercorrelated with the other measures described above. Author

N72-15070*# Public Health Service, Phoenix, Ariz. Applied Microbiology and Planetary Quarantine Section.
SERVICES PROVIDED IN SUPPORT OF THE PLANETARY QUARANTINE REQUIREMENTS OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Technical Report, Oct. - Dec. 1971
Martin S. Favero Feb. 1972 27 p
(NASA Order W-13062)
(NASA-CR-125419; Rept-36) Avail: NTIS CSCL 06M

The efficiency of a biodetection grinder, used to recover buried contamination, was tested using spacecraft components and laminated polystyrene strips containing Bacillus subtilis var. niger spores. The surfaces were decontaminated before tests. Results are given in tabular form. Tables are also given for heat resistance of bacteria spores, prevalence of bacteria in spacecraft before launch, and the types of bacteria found in Apollo 15 spacecraft components and command modules. E.H.W.

N72-15071# Los Alamos Scientific Lab., N.Mex.
RESPIRATOR EFFICIENCY MEASUREMENT USING QUANTITATIVE DOP MAN TESTS
E. C. Hyatt, J. A. Pritchard, and C. P. Richards 1971 20 p refs Presented at the Am. Ind. Hyg. Conf., Toronto, 24-28 May 1971
(Contract W-7405-eng-36)
(LA-DC-11959; Conf-710505-7) Avail: NTIS

The efficiency of high-performance dust respirators has been measured by sampling continuously from the interior of the facepiece while the wearer performed specified exercises in a quantitative aerosol man test chamber. The leakage into respirator facepieces equipped with high-efficiency particulate filters was measured with a light-scattering photometer and recorder. The four-decade photometer measured leakage of less than 0.01 percent to 100 percent in 2 seconds. The results indicate that this method of evaluating the fit of the respirator to the ultimate wearer provides an accurate and meaningful measurement of respirator efficiency for each person and respirator combination. Author (NSA)

N72-15072# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).
RELATIVE BIOLOGICAL EFFECTIVENESS OF 3-GeV PROTON BEAMS IN PRODUCING CATARACTS IN RABBITS
G. Legeay, C. Haye, J. Drouet, and J. P. Bazin 1971 19 p refs In FRENCH Presented at the Intern. Congr. on Protect. against Accelerator and Space Radiation, Geneva, 26-30 Apr. 1971
(CEA-CONF-1782; Conf-710423-7) Avail: AEC Depository Libraries

The production of caratacts in rabbits with monoenergetic beams was studied as a function of the relevant parameters. The experimental conditions and the physical, biological and opthalmologic data are reviewed. The rabbits were divided into groups corresponding to different doses. The latency time parameter and the dose-effect correlation enabled the RBE to be determined. The latency time was determined as a function of the dose rate for the various stages in the irradiation with gamma rays and a 3 GeV proton beam; the response functions were then plotted using logarithmic coordinates. The RBE increases with decreasing doses. The time necessary for a cataract to appear and the degree of development depend upon the dose rate. NSA

N72-15073# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
ON THE INSTANTANEOUS MEASUREMENT OF BLOODFLOW BY ULTRASONIC MEANS M.S. Thesis
M. G. J. Arts May 1971 30 p refs
(TH-71-E-20; ISBN-90-6144-020-3) Avail: NTIS

A method of estimating the average blood flow velocity over a cross section of a blood vessel from the received signal of a Doppler flowmeter, using continuous ultrasonic radiation, is described. The method is based on the determination of the frequency shift averaged over the power density spectrum of the received signal. Instrumentation featuring an HF amplifier, automatic volume control, pass band limitation for LF signals, and zero calibration, enables measurements to be done without complete frequency analysis of the signal. ESRO

N72-15074# Army Foreign Science and Technology Center, Charlottesville, Va.
MATHEMATICAL SIMULATION OF BEHAVIOR BASED ON THE THEORY OF TENDENCIES (SET)
V. V. Chavchanidze 26 Aug. 1971 10 p refs Transl. into ENGLISH from Soobshcheniya Akad. Nauk Gruzin. SSR (Tiflis), v. 54, no. 2 May 1969 p 297-300
(AD-729863; FSTC-HT-123-461-71; ACSI-J-9461; T702301-2301) Avail: NTIS CSCL 05/10

Important theoretical questions, which are pertinent to the physiology and psychology of the functioning of the brain, have not been solved by well known basic models. This report considers the necessity of the development of a theory of the entire organism, not just the brain. Until now, an axiom for a general theoretical and mathematical model of human behavior has not been formulated. Author (GRA)

N72-15075# Texas Technological Univ., Lubbock.
EFFECTS OF DECISION CRITERIA ON HUMAN DECISION-MAKING PERFORMANCE M.A. Thesis
Robert Duane Ireland May 1971 54 p refs
(Contract DAAD05-69-C-0102; Proj. THEMIS)
(AD-729828) Avail: NTIS CSCL 05/10

The specific objectives of the study is to determine if a strengthening of criteria for acceptable decision-making performance does afford those individuals relatively tolerant of ambiguity an opportunity to widen the effective performance gap between their decision-making activities and those of their contemporaries relatively intolerant of ambiguity. Another objective is to determine those variables or parameters that could be appropriately utilized by organizations to select individuals who are in fact relatively tolerant of ambiguity. Author (GRA)

N72-15076# Johns Hopkins Univ., Baltimore, Md. Dept. of Pharmacology.
THE EFFECT OF MICROWAVE IRRADIATION ON THE TURNOVER RATE OF SEROTONIN AND NOREPINEPHRINE AND THE EFFECT ON MONODAMINE METABOLIZING ENZYMES Final Report, Jun. 1967 - May 1971
Solomon H. Snyder 26 Aug. 1971 23 p refs
(Contract DADA17-69-C-9144)
(AD-729161; Rept-2) Avail: NTIS CSCL 06/18

The research program was directed at detecting neurochemical alterations in laboratory animals exposed to microwave irradiation at levels of 10 mW/sq cm. At this low level of irradiation, it was found that after 7 days exposure for 8 hours per day, there was a marked slowing of the serotonin turnover rate which was accompanied by a slight decrease in the activity of tryptophan decarboxylase and 5-hydroxytryptophan decarboxylase. This suggests that microwave irradiation decreased the firing rate of serotonin neurons in the brain. Since these neurons are known to participate in the regulation of sleep and wakefulness as well as body temperature, the findings may account for certain of the behavioral effects purportedly produced by microwave exposure. Author (GRA)

N72-15077# Naval Medical Research Inst., Bethesda, Md.
TIMING BEHAVIOR IN THE ASSESSMENT OF ADAPTATION TO NITROGEN NARCOSIS Interim Report
Joseph Michael Walsh and Arthur J. Bachrach 9 Jul. 1971 30 p refs
(AD-729289; NAVMED-M4306.03-2040D-2) Avail: NTIS CSCL 06/19

Research in psychological changes associated with hyperbaric pressure - particularly the behavior changes identified as nitrogen narcosis - has yielded varying and often inconsistent results. One phenomenon reported frequently in nitrogen narcosis is an acclimatization or adaptation to the conditions of the dive; thus, experienced divers are found to be less affected by narcosis. Precise quantification and identification of the behaviors and the environmental conditions under which they occur has been lacking in most hyperbaric studies dealing with adaptation to narcosis. The present study is a preliminary one dealing with an experimental analysis of time behavior, using operant conditioning techniques. Timing behavior in albino rats is found to be disrupted in an initial exposure to 200 feet on air. Subsequent exposures reveal gradual adaptation to the chamber conditions, with return to levels of performance close to surface control.
Author (GRA)

N72-15078# Edgerton, Germeshausen and Grier, Inc., Goleta, Calif.
LASER EYE EFFECTS: THE SUBVISIBLE RETINAL LESION Final Report, 1 Aug. 1969 - 31 Jul. 1971
William J. Mautner 14 Jul. 1971 93 p refs
(Contract DADA17-69-C-9013)
(AD-728852; EG/G-S-543-R) Avail: NTIS CSCL 06/5

The objective of this program was to investigate the effects of helium-neon and YAG laser radiation on the rabbit retina at exposure levels below those required to produce ophthalmoscopically visible lesions. The question of the existence of a subvisible retinal lesion was addressed using electroencephalographic (EEG) techniques' light microscopy, electron microscopy, and autoradiography. The characteristics of such a lesion and questions of reversibility were also investigated. The existence of the subvisible lesion was clearly established. Impairment of retinal function was seen by EEG at 50% of the visible lesion exposure threshold, while morphological and metabolic derangement was seen by microscopy and autoradiography at 83% of the visible threshold. A frequent return to normal was seen by the latter techniques in about 12 days, while general functional recovery was beginning to be seen by EEG in 14 days. YAG laser exposure produced an unexpected increase in potentials evoked from the exposed retina as seen in the EEG recordings. The reasons for this surprising result are not known. Electroencephalography is shown to be a sensitive and useful tool for the study of the subvisible retinal lesion. Author (GRA)

N72-15079# Army Environmental Hygiene Agency, Edgewood Arsenal, Md.
US ARMY TOPOGRAPHIC COMMAND OPTICAL DISTANCE MEASURING EQUIPMENT AGA MODEL 4 D GEODIMETER, FEBRUARY - APRIL 1971
David H. Sliney, Paul D. Tveten, and Robert Yacovissi Apr. 1971 10 p
(AD-729345; USAEHA-42-014-70) Avail: NTIS CSCL 06/18

An optical radiation hazards special study was performed on the AGA Model 4D Geodimeter used by the Field Surveys Division, USATOPOCOM, during February April 1971. It was found that this device, which is used for the precise measurement of distance, emits an optical beam which is a potential ocular hazard if appropriate safeguards are not employed. It was recommended that personnel not view the direct beam even momentarily within a range of 3 m and that personnel not continuously stare into the beam within 300 m in the finder beam mode or 200 m in the operating beam mode. Precautions relating to the use of a retroreflector at close ranges, directing the laser beam through glass, and the use of binoculars were given. Preplacement and periodic eye examinations for using personnel were also recommended. Author (GRA)

N72-15080# National Academy of Sciences-National Research Council, Washington, D.C. Committee on Hearing, Bioacoustics, and Biomechanics.
NON-AUDITORY EFFECTS OF NOISE
Karl D. Kryter, Gerd Jansen, Donald Parker, Horace O. Parrack, and George Thiessen Jun. 1971 31 p refs
(Contract N00014-67-A-0244-0021)
(AD-728426) Avail: NTIS CSCL 06/19

The report is a summary and evaluation of research findings that relate to any effects of noise other than to the ear and related structures. For example, included herein are research efforts concerned with psychological effects of noise, effects on task performance, effects on the cardio-vascular system, and on general health. This report also presents areas and types of research studies that may help to provide full answers to questions on the degree of noise control desirable with respect to the non-auditory effects of noise normally present in living and working environments. Author (GRA)

N72-15081# Texas Univ., Austin. Social Psychology Lab.
POLAC: A COMPUTER PROGRAM TO COMPUTE AUTO-, CROSS-LAGGED AND POOLED WITHIN-CELL CORRELATIONS
Roger Bakeman Jul. 1971 20 p refs
(Contract N00014-67-A-0126-0001; ONR Proj. 171-804)
(AD-730452; TR-15) Avail: NTIS CSCL 05/10

Program POLAC computes auto- and cross-lag intercorrelation. The program independently computes lagged correlation matrices for any number of treatment conditions (cells) and then computes a pooled within cell lagged intercorrelation matrix based on all cells. Missing observations, as defined by the user, may be excluded from the computations. The user specifies the lag(s) desired. Punched output may be obtained for use as input to multiple regression programs. Author (GRA)

N72-15082# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.
COMPARISION OF A WEIGHTED AUDITORY RISK CRITERIA WITH OCTAVE-BAND ESTIMATES Final Report, Nov. 1970 - Mar. 1971
Donald C. Gasaway and Harrell C. Sutherland, Jr. Jul. 1971 21 p refs
(AF Proj. 7755)
(AD-731154; SAM-TR-71-19) Avail: NTIS CSCL 06/19

The recent trend toward adoption of A-weighted sound levels to identify degrees of auditory risk has prompted investigations to determine modifications which must be made when applying the A-weighted method to specific noise environments. This report compares recently proposed criteria based on A-weighted sound levels with critical limits based on octave-band data as proposed by Working Group 46 of the Committee on Hearing, Bioacoustics, and Biomechanics of the National Academy of Sciences, National Research Council. The use of CA as a correction factor to equate dbA levels with octave-band assessments is discussed. Noise conditions within the cockpits of fixed- and rotary-wing aircraft were used as the basis for the comparisons. Results indicate that use of A-weighted sound levels for estimating potentially hazardous exposures of the type encountered in aircraft must be approached with caution for two reasons: (1) Spectrum content of a given noise influences the degree of auditory risk associated with single values of dbA, and (2) the relationship between duration and intensity of noise is curvilinear, rather than linear as assumed by the Walsh-Healey Act provisions. Author (GRA)

N72-15083# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
VERIFICATION AND EXTENSION OF DISPLAY SCANNING AND REMNANT MODELS USING AIRCRAFT LATERAL AND LONGITUDINAL DYNAMICS AS CONTROLLED ELEMENTS M.S. Thesis
Luis A. Machuca and James H. Lind May 1971 260 p refs
(AD-730154; GGC/EE/71-14) Avail: NTIS CSCL 05/10

An investigation of theoretical models of the human operator's scanning behavior and tracking performance while simultaneously controlling two closed-loop tasks using separate displays is undertaken. Two different two-display compensatory tracking situations are tested. The first uses transfer functions of K/s and K/(s-1) as controlled elements, and the resulting data is compared with that previously obtained under similar experimental conditions. The second uses the longitudinal and lateral dynamics of the F-4 as primary and secondary controlled elements, respectively, with a white noise input forcing function simulating a wind gust disturbance of selected bandwiths. Differences in the subject's scanning behavior, remnant, and tracking performance are noted for these two tracking situations. Scanning statistics show that pilots may adopt different average scanning and sampling strategies, and it is verified that the adjustable quasi-linear describing functions and remnant model proposed by STI do accurately predict the pilot's tracking performance under certain circumstances. It is shown that the pilot adjusts his scanning strategy in response to the tracking situation and that proposed scanning parameters may not accurately predict these changes. Possible mental processes for reconstruction are investigated and a weighted average form of reconstruction is outlined. Author (GRA)

N72-15084# School of Aerospace Medicine, Brooks AFB, Tex.
SOME DATA ON THE BIOLOGICAL EFFECT OF AND PROTECTION FROM LASER RADIATIONS
A. A. Gorodetskii, B. R. Kirichinskii, I. P. Evdokimov, and V. M. Kolesnik 1971 9 p refs Transl. into ENGLISH from "Nekotorye Dannye o Biologicheskom Deistvii i Zashchite ot Izluchenii Opticheskikh Kvantovykh Generatorov" Gigiena Truda i Professionalnye Zabolevaniya (USSR), 1968
(AD-730194; SAM-TT-R-1111-0971) Avail: NTIS CSCL 06/10

The most pressing tasks in the area of investigation of the biological effect of laser radiation are studies of the phenomena occurring in the cells, organs and tissues of the organism at the moment of application of radiation; determination of the regularities controlling the processes of absorption of laser energy and converting it to other types of energy; study of processes occurring in tissues and organs of irradiated animals following irradiation; establishment of a scientific basis for the maximum permissible levels of radiation and further development of measures for protection from the effects of laser radiation. GRA

N72-15085# Texas A&M Univ., College Station. Agricultural Experiment Station.
THE EFFECT OF HELIUM-OXYGEN ATMOSPHERE ON THE DEVELOPING CHICK EMBRYO AND SUBSEQUENT GROWTH OF CHICKS Final Report, 1 Feb. 1967 - 30 Jun. 1970
Thomas M. Ferguson, David H. Miller, Juan Valera, and Charles E. Sewell, Jr. Brooks AFB, Tex. School of Aerospace Medicine. Jul. 1971 51 p refs
(Contract F41609-67-C-0023; Task-793002)
(AD-730278; SAM-TR-71-8) Avail: NTIS CSCL 06/19

Hatchabiiity of chicken eggs in plastic chambers supplied with a flow-through of He-O2 (79%:21%) or compressed breathing air was compared with hatches in a commercial incubator (air). In the commercial incubator, hatches averaged 89.6%; in He-O2, 50.5%; and in air, 58.6%. Frequently, the He-O2 embryo failed to utilize all the albumen in the egg; some delays in time for hatch were observed. No gross or microscopic abnormalities were found attributable to the He-O2 atmosphere, and chicks from the He-O2 incubators showed no difference in growth, reproductive performance, or various physiologic measurements through 4 months of the F1 generation. The low hatchability in the plastic chambers (He-O2 and air) as compared to eggs set in the commercial incubator, when considered with other observations, suggests that suboptimum conditions of physical factors were responsible for the results rather than any effect due to helium per se. Author (GRA)

N72-15086# School of Aerospace Medicine, Brooks AFB, Tex.
UNEVEN VENTILATION AS A CONTINUOUS DISTRIBUTION FUNCTION OF ALVEOLAR DILUTION Interim Report, Jun. 1968 - Dec. 1969
Philip D. Manfredi and Robert G. Rossing Aug. 1971 35 p refs
(Task-631902)
(AD-730279; SAM-TR-71-30) Avail: NTIS CSCL 06/16

Replicate nitrogen washout curves recorded in 10 normal subjects were analyzed both by the classical Fowler model and by a model which treats the alveolar dilution ratio as being a continuously distributed variable. The majority of the curves could be satisfactorily fitted by assuming the distribution function to be single and Normal (Gaussian); less frequently a bimodal function was required which was composed of two Normal distributions. Pulmonary clearance delay (PCD) values were derived from each model and also by a method of calculation directly from the raw data. The values obtained by all three methods agreed very well, and the three methods may be regarded as equivalent and interchangeable. By any of the three methods, all subjects except one showed on at least one occasion a PCD less than 10%, but frequently the second of the paired determinations was somewhat higher (up to 30%). One subject, although considered normal on the basis of routine clinical testing, showed values which ranged from 30%-100% delay. Author (GRA)

N72-15087# Human Resources Research Organization, Alexandria, Va.
ANALYSIS OF VISUAL DISCRIMINATIONS IN HELICOPTER CONTROL
J. R. Thielges and W. G. Matheny Jun. 1971 163 p refs
(Contract DAHC19-70-C-0012; DA Proj. 2Q0-62107-A-712)
(AD-730500; HUMRRO-TR-71-13) Avail: NTIS CSCL 05/10

The visual Discrimination Analysis is a method of examining the cue structure of the helicopter pilot's visual environment. It is hypothesized that the critical cue is the relationship between two referents--a fixed internal referent placed on the helicopter windscreen and an external referent located on the ground plane. Cue value is analyzed through the geometric relationships of these referents for the six degrees-of-freedom: pitch, roll, yaw, altitude, range, and latitude. The pilot's ability to detect perturbation will depend upon its magnitude, initial state of the craft, location of the internal and external referents, and his threshold for detecting the relative motion of two points. A mathematical model is used to generate data for a sample analysis of pitch, and the data are graphed to explore referent placements that provide detectable cues. The information density plot is then developed as a means of examining the cue value of an entire field of external referents with respect to one or more internal referents. Author (GRA)

N72-15088# Naval Medical Field Research Lab., Camp Lejeune, N.C.
AN ASSESSMENT OF THE POTENTIAL VALUE OF HEAT ACCLIMATIZATION SPACES ABOARD THE LHAS, PHASE 3
John S. Douglas, Jr. and Philip J. Rasch Sep. 1971 21 p refs
(M Proj. 4311)
(AD-730472; NMFRL-Vol-21/No-21; NAVMED-M4311.01-1003BAC5-3) Avail: NTIS CSCL 06/19

One group of troops performed calisthenics and running in place for one hour in a heat chamber maintained at 36.7C dry bulb and 31.1C wet bulb. Another group performed the same exercises outdoors in a cool ambient temperature. The training program lasted one hour a day for two weeks. Standard work assessment tests were conducted before and after training. The acclimatization procedure was found to produce significant reductions in resting and post-work rectal temperature and in post-work heart rate. Increased sweat production was also observed. Significant similar changes were not observed in the control group. Author (GRA)

N72-15089# Eye Research Foundation of Bethesda, Md.
THE EFFECT OF WAVELENGTH ON THE ORGANIZATION OF THE REPTILIAN VISUAL SYSTEM Final Report, 1 May 1969 - 30 Apr. 1970
David O. Robbins, C. R. Gavonius, and Robert M. Chapman Wright-Patterson AFB, Ohio AMRL Jul. 1971 51 p refs
(Contract F33615-69-C-1685; Task-723303)
(AD-730286; AMRL-TR-70-140) Avail: NTIS CSCL 06/16

Spectral sensitivity curves were derived for cells isolated in the optic tectum of turtles. All cells were most sensitive to the red region of the visible spectrum with some cells showing a secondary peak in the blue-green region. The majority of cells showed an on-off response to wide field monochromatic stimulation. Plots of spectral sensitivity for on and off responses were often the same and the shapes of these curves suggested antagonistic inputs from spectrally different processes. In other cells, distinct differences were noted in the sensitivity functions for the on and off portions of the response, although both curves appeared to be the result of the combination of the same two visual pigments. In a third group of cells, a complete shift in the elicited response pattern was observed with stimulus wavelengths at one end of the spectrum eliciting an on response and at the opposite end, an off response. The data suggest that the reptilian optic tectum may be involved in hue discrimination.
GRA

N72-15090# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
PSYCHOLOGICAL CORRELATES OF A MODEL OF THE HUMAN VISUAL SYSTEM M.S. Thesis
Arthur Phillip Ginsburg Jun. 1971 121 p refs
(AD-731197; GE/EE/71S-2) Avail: NTIS CSCL 05/10

A model of the human visual system is investigated for psychological correlates. A priori hypotheses from the model concerned with human identification of defocused letters as well as identification of rotated letters have been validated with the computer model. Gestalt principles of similarity, proximity, closure, and figure-ground perception as well as geometric illusions are explained in terms of spatial filter bandwidth using the optics homolog. The experimental results have allowed postulates which extend the model by means of another cortical transform and a spatial filter shape which is also psychologically correlated. It is further postulated that the human perceptual space is the image domain from spatially filtered transforms of object forms. It is concluded that the model provides a means of obtaining quantitative psychological correlates of the human visual system. Recommendations are made for additional investigations concerning psychological correlates. Author (GRA)

N72-15091# School of Aerospace Medicine, Brooks AFB, Tex.
EVOKED RESPONSES IN THE AUDITORY CORTEX OF THE CAT TO DIFFERENT SOUND ORIENTATION, PART 1
N. Yu. Alekseenko 1971 14 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatelnosti (Moscow), v. 18, no. 4, 1968 p 642-649
(AD-730191; SAM-TT-R-1107-0971-Pt-1) Avail: NTIS CSCL 06/16

The evoked potentials (EP) were compared in the primary auditory and associative zones of the brain of anaesthetized cats under the acoustical clicks stimulation of the ipsi- or contralateral ear. Under various sound direction, the EP of identical cortex areas has a different form, differing from each other in the presence or absence of this or that component: the negative phase of the primary response, advance positive or negative oscillation, late positive-negative wave, etc. These differences of EP forms, appearing in the ectosylvian and in the suprasylvian gyri, indicate that the activity organization of the auditory cortex is different depending upon the direction of the acoustical stimuli. In the case of binaural stimulation, EP did not combine both forms but followed one of them, peculiar to either ipsi- or contralateral stimuli, while the effect from the stimulation of the other ear was inhibited. Thus, the spatial-temporal structure of the response in the auditory and associative zones of the cortex may contain information related to the side of the acoustic stimulation. Author (GRA)

N72-15092# School of Aerospace Medicine, Brooks AFB, Tex.
EVOKED RESPONSES IN THE AUDITORY CORTEX OF THE CAT TO SOUNDS FROM DIFFERENT DIRECTIONS. PART 2: QUANTITATIVE CHARACTERISTICS
N. Yu. Alekseenko and I. P. Levshina 1971 13 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatelnosti (Moscow), v. 18, no. 6, 1968 p 1001-1008
(AD-730192; SAM-TT-R-1108-0971-Pt-2) Avail: NTIS CSCL 06/16

The summary evoked potentials in the auditory cortex (AI) of the narcotized cat differ in their quantitative characteristics depending on the side of monaural auditory stimulus. When the contralateral ear is stimulated, the latent periods of the various phases of the EP and the duration of its positive phase are shorter, the amplitude is higher and the thresholds of development of its individual components are lower than with stimulus of the ipsilateral ear by a sound of equal superthreshold intensity. The amplitudes and latent periods of the associative responses, tapped at the suprasylvian gyrus, show the same dependence on the ear to which the signal is applied. These differences in EP parameters indicate higher excitability of the elements which form it with contralateral stimulation; the participation of a larger number of such elements in this reaction, and their earlier synchronous involvement. It can be assumed that the difference in the characteristics of responses to monaural signals of various directions are superimposed on the binaural effect with binaural interactions, reenforcing it and may therefore facilitate in distinguishing the direction of a source of sound. Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering, protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N72-15093* Lundy Electronics and Systems, Inc., Glen Head, N.Y.
INERTIAL WASTE SEPARATION SYSTEM FOR ZERO G WMS Final Report
9 Dec. 1971 95 p refs
(Contract NAS9-11268)
(NASA-CR-115327; Rept-1506-4-R7) Avail: NTIS CSCL 06I

The design, operation, and flight test are presented for an inertial waste separation system. Training personnel to use this system under simulated conditions is also discussed. Conclusions indicate that before the system is usable in zero gravity environments, a mirror for the user's guidance should be installed, the bounce cycle and bag changing system should be redesigned, and flange clips should be added to improve the user's balance. E.H.W.

N72-15094*# Scientific Translation Service, Santa Barbara, Calif.
ISOMETRIC EXERCISES: A MEANS OF PREVENTING MUSCULAR ATROPHY IN THE TREATMENT OF FRACTURES OF THE EXTREMITIES
Z. M. Atayev Washington NASA Dec. 1971 11 p refs Transl. into ENGLISH from Vopr. Kurortol. Fizioterapii i Lecheb. Fiz. Kult. (Moscow), v. 32, Mar.-Apr. 1967 p 140-145
(Contract NASw-2035)
(NASA-TT-F-14096) Avail: NTIS CSCL 05E

Tests using static tension of the muscles immobilized from traumas to prevent muscular atrophy were carried out. It was found that isometric tension of the muscles lasting 5 to 7 seconds, used in a general complex of physical exercises, is an effective means of preventing muscular atrophy. Author

N72-15095*# General Electric Co., Philadelphia, Pa. Space Div.
IMPROVED AESTHESIOMETER Patent Application

Robert W. Richardson and David B. Wright, inventors (to NASA) Filed 2 Dec. 1970 11 p
(Contract NASw-1630)
(NASA-Case-MSC-13609-1; US-Patent-Appl-SN-94347) Avail: NTIS CSCL 06B

An aesthesiometer for detecting and measuring cutaneous sensory perception is described. The instrument comprises an elongate tubular housing having a sleeve member extending axially from one end. On the other end of the tubular housing, a vernier counter adjustment is mounted with the operating mechanism disposed internally of the housing. Within the sleeve a thin wire-like member of monofilament stimulating element is telescopically positioned. One end of the monofilament stimulating element extends from the sleeve while the other end is mechanically coupled to the internal operating mechanism of the vernier counter adjustment. The cutaneous sensory perception of the subject is recorded with a single stimulating element. The sensory perception level may be noted by reference to the clocklike face and index mark on the housing. NASA

N72-15096*# Baylor Univ., Houston, Tex. Coll. of Medicine.
IMPROVED BIOMEDICAL ELECTRODE Patent Application
James D. Frost, Jr., inventor (to NASA) Filed 5 Nov. 1970 13 p
(Contract NAS9-9418)
(NASA-Case-MSC-13648-1; US-Patent-Appl-SN-87222) Avail: NTIS CSCL 06B

A disposable electrolyte saturated sponge electrode, used to collect biomedical data, is described. The electrolyte is composed of a metallic electrode disk carried in a rubber silicon base. The sponge is formed above the base. Advantages of the device include indefinite storage without deterioration or special arrangements, and simple procedures for installation and use. The electrode records physiological signals. E.H.W.

N72-15097*# General Electric Co., Philadelphia, Pa.
REACTION TESTER Patent Application
Harry H. Brown, inventor (to NASA) Filed 7 Oct. 1970 14 p
(Contract NASw-1630)
(NASA-Case-MSC-13604-1; US-Patent-Appl-SN-78717) Avail: NTIS CSCL 05E

A reaction tester is described for testing the simple and disjunctive reaction of a subject to light stimuli. It is in the form of a bar member which has spaced grooves for receiving the index fingers of a subject. Near the bottom of each groove are openings aligned along a transverse axis to a groove and a light beam is projected through the openings to a photo transistor. The subject's finger breaks the light beam and when the finger is moved relative to the groove, the light beam actuates the transistor. A logic circuit is provided to interconnect the reaction key to a panel having neon light indicators. A ready light informs the subject that the test will begin. Then either the left or right, or both, lights are actuated through the logic circuit. A counter is started and when the subject reacts by moving the correct finger, the light indicator is extinguished and the counter is stopped. An incorrect reaction causes an error indicator to operate. NASA

N72-15098*# General Electric Co., Philadelphia, Pa. Space Div.
AUTOMATIC CONTROL OF LIQUID COOLING GARMENT BY CUTANEOUS AND EXTERNAL AUDITORY MEATUS TEMPERATURES Patent Application
Clay W. G. Fulcher, inventor (to NASA) Filed 12 Nov. 1971 20 p
(Contract NAS9-10963)
(NASA-Case-MSC-13917-1; US-Patent-Appl-SN-198355) Avail: NTIS CSCL 06Q

An automatic control apparatus for a liquid cooling garment is described that is responsive to actual physiological needs during work and rest periods of a man clothed in the liquid cooling garment. Four skin temperature readings and a reading taken at the external portion of the auditory meatus are added and used in the control signal for a temperature control valve regulating inlet water temperature for the liquid cooling garment. The control apparatus comprises electronic circuits to which the temperatures are applied as control signals and an electro-pneumatic transducer attached to the control valve. NASA

N72-15099*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECT OF MODIFYING RESPONSE AND PERFORMANCE FEEDBACK PARAMETERS ON THE CNV IN HUMANS
David A. Otto (Stanford Univ.) and Larry J. Leifer Jan. 1972 16 p refs
(NASA-TM-X-62097) Avail: NTIS CSCL 05E

The effect on the CNV of sustained and delayed motor response with the dominant and nondominant hand in the presence and absence of visual performance feedback, was studied in 15 male adults. Monopolar scalp recordings were obtained at Fz, Cz, Pz, and bilaterally over the motor hand area. Results indicated that the magnitude of the CNV was greater in the delayed than sustained response task, greater in the presence than absence of feedback, and greater over the motor hand area contralateral to movement. Frontal CNV habituated in the sustained, but not the delayed response task, suggested that frontal negative variations in the former case signify an orienting response to novelty or uncertainty. The absence of habituation in the delay condition was interpreted in terms of the motor inhibitory function of frontal association cortex. Performance feedback appeared to enhance CNV indirectly by increasing the motivation of subjects. A multiprocess conception of CNV was proposed in which vortex-negative slow potentials reflect a multiplicity of psychophysiological processes occurring at a variety of cortical and subcortical locations in the brain preparatory to a motor or mental action. Author

N72-15100*# Techtran Corp., Glen Burnie, Md.
BIOTECHNICAL LIFE SUPPORT SYSTEM FOR SPACE OBJECTS
Washington NASA Jan. 1971 14 p refs Transl. into ENGLISH of the book "Biotechnicheskaya Sistema Zhinneobespechniya Kosmicheskikh Obyektov" USSR Academy of Sciences, Moscow, Nauka Press, 1970 11 p
(Contract NASw-2037)
(NASA-TT-F-14102) Avail: NTIS CSCL 06K

A mockup of a biotechnical life support system for space objects is described. It includes a sun simulator for growing plants, gas exchange apparatus, hothouse, chicken cultivator, algae cultivator, heat and moisture regulating system, lighting system, waste product collection system, bathroom with shower, and other components. Under present conditions, necessary supplies for space flights of up to 3 years weigh tens of tons. The system would weigh considerably less. Its principle is regeneration of substances necessary for maintenance of life at an adequate level for carrying out flight operations. Author

N72-15101# National Aviation Facilities Experimental Center, Atlantic City, N.J.
THE DEVELOPMENT OF A MOTION PICTURE MEASUREMENT INSTRUMENT FOR APTITUDE FOR AIR TRAFFIC CONTROL Final Report, Nov. 1970 - Nov. 1971
E. P. Buckley and Tom Beebe Jan. 1972 32 p refs
(Proj. 012-609-04X)
(FAA-RD-71-106) Avail: NTIS

A motion picture test for aptitude of human subjects to perform air traffic control duties is described. Estimates of reliability and validity as obtained from the administration of the test to 19 air traffic control specialists are discussed. Test results are presented in the form of charts and graphs. Author

N72-15102# Civil Aeromedical Inst., Oklahoma City, Okla.
PERSONALITY ASSESSMENT IN AVIATION: AN ANALYSIS OF THE ITEM AMBIGUITY CHARACTERISTICS

OF THE 16PF AND MMPI
Roger C. Smith Jul. 1971 7 p refs
(FAA-AM-71-35) Avail: NTIS

The problem of item ambiguity (the degree to which an item elicits multiple interpretation) which may limit the utility of 16PF and MMPI devices when used in screening procedures is examined. Subjects completed either the 16PF or the MMPI while concurrently rating each item on a five-point ambiguity scale. The ambiguity for each item was determined and the relationship between ambiguity and sex of the respondent, the individual factor scales, and the scores of subjects on the scales was considered. The implications of the findings for item construction and use of the test in various applications were discussed. Author

N72-15103# California Univ., Livermore. Lawrence Radiation Lab.
SUGGESTED GUIDELINE FOR LOW DOSE RADIATION EXPOSURE TO POPULATIONS BASED ON BENEFIT-RISK ANALYSIS
Jerry J. Cohen Jun. 1971 21 p refs Presented at the 16th Ann. Health Phys. Soc. Meeting, New York, 14 Jul. 1971
(UCRL-72848; CONF-710710-8) Avail: NTIS

The basis for standards set by the International Commission on Radiological Protection, the National Council on Radiation Protection, and the Federal Radiation Council for the maximum permissible radiation dose of the general human population is critically reviewed. It is suggested that the recommendation of a maximum average radiation dose of 170 mrem/yr for human populations be abolished and replaced by the use of a new unit called the Mer. The Mer is defined as that amount of benefit required to justify an exposure to one rem. It is postulated that application of some form of benefit-risk analysis in deriving radiation guidelines would have the effect of placing low dose exposure risks into commonly comprehensive perspective. NSA

N72-15104# Army Foreign Science and Technology Center, Charlottesville, Va.
STUDY OF DYNAMIC VISUAL ACUITY
M. G. Kozyrkova 26 Aug. 1971 10 p refs Transl. into ENGLISH from Probl. Fiziol. Optiki (Moscow), v. 15, 1969 p 138-141
(AD-729865; FSTC-HT-23-446-71; ASCI-J-9467) Avail: NTIS CSCL 06/16

The resolution of the eye, determined on the basis of following moving objects, is called the dynamic visual acuity. Studies of dynamic visual acuity have shown that as the speed of the object increases the dynamic visual acuity deteriorates. Distinguishing moving objects is a much more complex problem than distinguishing fixed objects. Author (GRA)

N72-15105# Texas Technological Univ., Lubbock. Center of Biotechnology and Human Performance.
EFFECTS OF WORK/REST SCHEDULES ON MONITORING PERFORMANCE IN THE HEAT Ph.D. Thesis
Amr K. Mortagy Aug. 1971 155 p refs
(Contract DAAD05-69-C-0102)
(AD-729829) Avail: NTIS CSCL 06/19

The purpose of the investigation was to study the effects of work/rest schedules on human performance in hot climates. A visual monitoring task was used as the performance criterion and two performance parameters were measured, percent correct detections and percent correct responses. Author (GRA)

N72-15106# Texas Technological Univ., Lubbock. Center of Biotechnology, Fatigue and Human Performance
THE BIOMECHANICS OF PUSHING AND PULLING TASKS
M. M. Ayoub and Joe W. McDaniel Aug. 1971 253 p refs
(Contract DAAD05-69-C-0102; DA Proj. 1T0-14501-B-81-a; Proj. Themis)
(AD-729827; THEMIS-603) Avail: NTIS CSCL 06/16

A considerable amount of work has been done to determine the forces that man can exert on loads. However, very little has been done to determine the skeletal configurations an operator should assume in front of a load to be most efficient. This report investigates these skeletal configurations and selects an optimum for pushing as well as pulling of loads. It also includes a biomechanical analysis of the forces and torques developed at the joints as well as on the lower spine. Author (GRA)

N72-15107# RAND Corp., Santa Monica, Calif.
PILOT MANAGEMENT POLICY AND PILOT TRAINING RATES
W. A. Stewart Mar. 1971 109 p refs
(Contract F44620-67-C-0045)
(AD-729760; R-690-RR) Avail: NTIS CSCL 05/9

A study was made of the effects of lengthening the initial cockpit flying time for Air Force pilots. Changing the number of operational flying years required of career pilots, the number of years required of all pilots in their initial cockpit tours, and the timing of career rotation from cockpit to nonflying duty will change the number and cost of new pilots to be trained. Criteria by which the author assesses alternative pilot management policies include pilot quality, cost, career development, mobilization potential, acceptability, and replacement training rate--the number per thousand man-years at which new pilots must be trained to supply a given number of operational cockpit man-years. Lengthening initial cockpit tours could reduce training programs and initial training costs, improve quality, reduce recurrent advanced-pilot-training costs, and provide career pilots more time away from operational flying. Author (GRA)

N72-15108# Naval Ammunition Depot, Crane, Ind.
EFFECTS OF LOW INTENSITY MICROWAVES ON PERFORMANCE
John P. Jankovich 1 Jul. 1971 42 p refs
(AD-730105; NAD-CR-RDTR-187; Work-Unit-2) Avail: NTIS CSCL 05/10

The purpose of the investigation was to determine the effects of low intensity microwave frequency electromagnetic signals on performance. Animal experiments were devised exposing Rhesus monkeys to microwave radiation for 10-95 minutes, while performing an operant conditioned task which is a universally applied psychological technique to measure the performance in order to establish the effects of microwaves on activity level of the organism. The intensity levels of microwave exposure were 10mwatts/sq cm and 13mwatts/sq cm at 750 MHz, 3mwatts/sq cm and 8mwatts/sq cm at 1000 MHz frequencies. Exposure to microwaves was found to decrease the performance rate directly proportional to field intensity and exposure time. No difference was observed in the general detrimental effects of microwaves at the frequency of 750 MHz vs 1000 MHz, and under continuous vs pulsed (2-12 Hz) irradiation. Low intensity radiation (3 mw/sq cm) seemed to have a double effect on performance: stimulation during short exposure, inhibition during longer exposure. Further deterioration of performance can be expected in the execution of more complex psychological tasks than the one employed in the report, or under higher intensity levels. Author (GRA)

N72-15109# Naval Personnel and Training Research Lab., San Diego, Calif.
NEW CONCEPTS OF AVIATION APPRENTICESHIP QUALIFICATIONS Final Report
Joseph R. Heinzel Aug. 1971 102 p refs
(Proj. PF39.521.009.01.11)
(AD-729654; SRR-72-7) Avail: NTIS CSCL 05/9

Current Airman (AN) qualifications are applied equally to all Group IX (Aviation) ratings although they are actually fleet/squadron oriented and do not reflect realistic professional requirements applicable as an apprenticeship to all work areas in the aviation rating structure. Research was initiated to review current AN qualifications to determine the desirability and practicability of developing common core qualifications supplemented by rating-oriented items. Data initially gathered

and analyzed indicated it was neither feasible to group AN qualifications into the aircraft maintenance, operational, and clerical areas nor to develop AN advancement qualifications which would be class 'A' service school oriented. The research approach was therefore revised to provide for the development of new AN advancement qualifications encompassing general aviation knowledge factors only. Author (GRA)

N72-15110# Dunlap and Associates, Inc., Santa Monica, Calif.
ADAPTIVE DISPLAYS
Charles R. Kelley and Daniel J. Prosin 30 Jul. 1971 72 p
(Contract F44620-69-C-0129; AF Proj. 9778)
(AD-729985; AFOSR-71-2357TR; FR-2; Rept-61102f; Rept-681313) Avail: NTIS CSCL 05/9

An adaptive display assists the human operator in detecting, diagnosing and adapting to changes in a system under his control or its environment. Adaptive displays generated by a fast-time predictive model of the controlled element were employed. In the first experiment, a time history display of the real system behavior painted on the same display surface as was the prediction from the fast time model permitted quicker recognition of small changes and made more accurate recognition of the extent of small or large ones. Errors in prediction notified the operator of the need to adapt. Subsequent experiments showed that a predictive display was valuable in adapting to slow continuous changes in a controlled element, such as changes in aircraft trim with fuel consumption, or quicker changes, such as involved in mode transitions as when VSTOL aircraft go from hover to cruise or the reverse. Author (GRA)

N72-15111# Naval Aerospace Medical Inst., Pensacola, Fla.
EFFECTS OF ALCOHOL INGESTION ON TRACKING PERFORMANCE DURING ANGULAR ACCELERATION
William F. Collins, Richard D. Gilson, David J. Schroeder, and Fred E. Guedry, Jr. May 1971 24 p refs Sponsored in part by FAA Prepared in cooperation with Army Aeromedical Res. Lab., Fort Rucker, Ala.
(MF Proj. 12.524.004)
(AD-729679; NAMRL-1133; USAARL-71-20) Avail: NTIS CSCL 06/19

Following practice, two groups of 10 subjects each were given pre-(baseline) tests of tracking performance in both static (stationary) and dynamic (whole body angular acceleration) conditions. One group then received orange juice which contained 2.0 ml of 100-proof vodka per kg of subject weight; the other group drank orange juice with a few drops of rum extract added. All subjects were led to believe that they were receiving alcohol. Additional tests were conducted 1, 2, 4, 8, and 10 hours after drinking. All tests were in total darkness with the exception of the visual display which was illuminated to a level recommended for cockpit instruments. Static tracking error declined slightly for the control group, but increased over the pre-drinking level during the 1-, 2-, and 4-hour tests for the alcohol group; only the 1-hour scores differed significantly from the pre-scores for the alcohol group. In comparing the two groups, static tracking errors for alcohol subjects were significantly higher than those of control subjects only at the 4-hour session when the effects of alcohol were beginning to wane. However, in the dynamic tests, alcohol subjects made significantly more tracking errors than control subjects during the 1-, 2-, and 4-hour sessions. These data suggest that eye-hand coordination may show little or no impairment following alcohol ingestion in static situations, yet may be seriously degraded during motion. Author (GRA)

N72-15112# Navy Experimental Diving Unit, Washington, D.C.
SWIMMER SUPPORT SYSTEM DIVING PROCEDURES AND TABLES Final Report
William H. Spaur and Edward T. Flynn, Jr. 17 Aug. 1971 10 p
(AD-728759; NEDU-RR-10-71) Avail: NTIS CSCL 06/11

Diving tables and procedures are presented for use with swimmer delivery vehicles and open circuit, semi-closed circuit and closed circuit underwater breathing apparatus. Author

N72-15113# Navy Experimental Diving Unit, Washington, D.C.
NAVY-DUKE 600 FOOT SATURATION DIVE Final Report
Edward T. Flynn, Jr. and James K. Summitt 25 May 1971 87 p refs
(AD-729665; NEDU-RR-8-71) Avail: NTIS CSCL 06/11

Four U.S. Navy first class divers, a Medical Officer, and a civilian laboratory technician were compressed to a simulated depth of 600 feet of sea water in the Duke University Hyperbaric Complex. During the subsequent 7 days at 600 feet, two warm (90F) and 5 cold (43-49F) water experiments were conducted in order to assess the performance of the Mark IX semi-closed circuit UBA at depth. From these tests, it was concluded that the Mark IX could safely support a hard working diver in cold water at 600 feet, although the thermal sensitivity of the carbon dioxide canister limited the useful duration of the apparatus. In addition, the importance of heating the inspired gas during deep dives in cold water was noted. Author (GRA)

N72-15114# Texas Technological Univ., Lubbock. Center of Biotechnology and Human Performance.
CREW PERFORMANCE IN EXTENDED OPERATION UNDER VIBRATIONAL STRESS Ph.D. Thesis
Mohamed A. El-Nawawi Aug. 1971 234 p refs
(Contract DAAD05-69-C-0102)
(AD-729373) Avail: NTIS CSCL 06/19

The study was conducted in an attempt to investigate the effects of prolonged vibration on performance and recovery of different crews involved in the operation of a multi-station work system. Eight-, six-, and five-man crews were under investigation while operating a 4-station work system. The performance measure was a compensatory one-dimensional vertical tracking task. This task was performed under normal and vibrational environments. The simulated 4-station system's mission duration was taken as 4 hours, wherein performance data were collected. Crew recovery was monitored throughout a 20-minute period after mission completion. Two work cycles (60 minutes and 30 minutes) were used in the different crews' work schedules. The vibrational stress imparted to the crew members was a vertical sinusoidal type of 5 cps frequency, 0.16 inch constant amplitude (DA), and 0.20 g acceleration intensity level. The significant conclusions drawn from this study are listed. GRA

N72-15115# Monsanto Research Corp., Dayton, Ohio.
FOAM FLOTATION SYSTEMS FOR PERSONNEL WEARING BODY ARMOUR Final Report, Feb. 1969 - Sep. 1970
I. O. Salyer, J. L. Schwendeman, A. Wojtowicz, R. T. Jefferson, and S. M. Sun Jul. 1971 116 p refs
(Contract DAAG17-69-C-0017; DA Proj. 1F1-64207-DC-52)
(AD-731000; USA-NLABS-72-3-CE; C/PLSEL-87) Avail: NTIS CSCL 06/7

A feasibility study was conducted on approaches to using foams in flotation systems for personnel wearing body armor. Flotation systems should be rapidly deployable (10 seconds) and provide flotation for at least six hours, even if damaged. The systems should not interfere with the wearer as he performs his duties. Three approaches were investigated: (1) the use of performed flexible foam: (2) instantly generated polystyrene foam: and (3) fast reacting two-component urethane foams. Only the preformed flexible foam performed well when fabricated into a jacket and tested on a man. Author (GRA)

N72-15116# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
AN INTRODUCTION TO RELAXED HAND ANTHROPOMETRY
John W. Garrett Aug. 1971 9 p ref
(Task-718408)
(AD-731183; AMRL-TR-67-217) Avail: NTIS CSCL 05/5

Anthropometric data comparing the length of the relaxed hand with the flat, straightened hand are presented. The correlation coefficient between the hand length in the two positions is not high. A forthcoming comprehensive research program on the anthropometry of the hand is revealed.
Author (GRA)

N72-15117# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
DISPLAY DESIGN FOR ELECTRONIC COUNTERMEASURES APPLICATION: SCOPE SIZE AND THREAT DENSITY Final Technical Report, Oct. 1970 - Jan. 1971
David F. Thornburn, Earl D. Sharp, William N. Kama, and John P. Lyons Jul. 1971 29 p refs
(Task-718410)
(AD-731186; AMRL-TR-71-69) Avail: NTIS CSCL 05/5

Subjects were required to identify threat symbols on a simulated electronic countermeasures (ECM) scope display while performing a single-axis, first-order, unstable compensatory tracking task. Performance with 3- and 4-inch-diameter display scopes was compared. A repeated-measures experimental design was used involving two different 30-minute test missions, each varying in threat density from 0 to 18. Twenty right-handed male college students served as subjects. By comparing subject performance at the various threat densities it was determined that 7 was the maximum number of threats that a subject could effectively process with each scope size. Results showed no statistically significant difference in performance between the 3-inch and the 4-inch scopes. Author (GRA)

N72-15118# Human Engineering Labs., Aberdeen Proving Ground, Md.
A REVIEW OF IMPULSE-NOISE RESEARCH AT THE HUMAN ENGINEERING LABORATORIES
David C. Hodge Apr. 1971 41 p refs Presented to Del. Valley Chapter, Acoustical Soc. of Am., Rose Tree, Pa., 6 Jan. 1971
(AD-731185; TN-4-71) Avail: NTIS CSCL 05/5

The significance of impulse-noise exposure as a severe Army problem is discussed. Efforts at alleviating these problems are reviewed under five subject categories: development of measurement techniques, conduct of temporary hearing loss investigations, noise suppression experiments, determination of the limits of hearing protection, and development of hearing damage-risk criteria. Author (GRA)

N72-15119# School of Aerospace Medicine, Brooks AFB, Tex. Otolaryngology Branch.
AEROMEDICAL REVIEW: PERSONAL EAR PROTECTION Final Report, Jul. 1968 - Jan. 1971
Donald C. Gasaway Aug. 1971 150 p refs
(Task-77508)
(AD-731182; SAM-TR-71-13; SAM-Review-2-71) Avail: NTIS CSCL 06/17

Various aspects of personal ear protection are discussed and illustrated. Results obtained from a selective survey of available literature dealing with the topic of ear-protection devices and technics are presented. Numerous methods used for evaluating the attenuation characteristics of ear-protection devices are discussed. In addition to attenuation, additional features which influence overall acceptability of given types of devices are also discussed. Attenuation values representative of the majority of ear-protection devices thus far developed and studied in the United States are presented in illustrated form. The content of this review provides meaningful and comprehensive understanding of salient underlying features of attenuation, wearability, and overall effectiveness associated with the use of various ear-protection devices. The contents provide the reader with cognizance of the many variables which tend to modify and ultimately affect successful selection and use of personal ear-protection devices. Author (GRA)

N72-15120# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
AIRCRAFT TRACK INITIATION AND MAINTENANCE IN A SINGLE-OPERATOR SIMULATED SURVEILLANCE SYSTEM: TECHNICAL REPORT 1 Final Report
Robert G. Mills and Michael A. Bauer (Dayton Univ.) Jul. 1971 37 p refs
(Task-718409)
(AD-730609; AMRL-TR-71-103) Avail: NTIS CSCL 17/9

A semiautomatic radar surveillance system using a time-compression display was simulated. Subjects were required to detect targets entering the surveillance area (75 by 75 nautical miles), initiate automatic tracking of these targets, and reinitiate (maintain) lost tracks when automatic tracking failed. Four target introduction rates (1, 2, 3, and 4/minute), three levels of clutter density (0.016, 0.032, and 0.064 pieces/square nautical mile), and two levels of practice (replications) were investigated. Results indicate that increases in target introduction rate generally degrade subject performance (e.g., track initiation time increases), clutter has little effect on performance, track initiation is sensitive to practice, improving from the first replication to the second, and track maintenance is relatively insensitive to practice. The dynamic characteristics of surveillance tasks require the development of a queuing model to describe human performance in semiautomatic surveillance systems.
Author (GRA)

N72-15121# Wyle Labs., Inc., Rockville, Md.
NOTES ON THE INITIATION OF LIMB FLAILING Final Report, 1 Mar. 1970 - 15 Apr. 1971
Peter R. Payne Wright-Patterson AFB, Ohio AMRL Aug. 1971 21 p refs
(Contract F33615-70-C-1420; Task-723101)
(AD-731195; Working-Paper-59111-8; WR-71-13; AMRL-TR-71-45) Avail: NTIS CSCL 06/7

An analysis is made of the aerodynamic forces tending to pull the limbs and head of an ejection seat occupant away from their rest position. Two distinct mechanisms are identified: forward acting pressure forces which are shown to act on the front of any body, and a forward acting force caused by an obstruction behind the body. Quantitative estimates of these forces show that they may far exceed the ability of the occupant to hold his limbs in position. Various possible remedies are discussed, including, for example, the use of flaps or spoilers to change the angle at which the flow separates from the limb or helmet should eliminate these forward acting forces, and hence prevent limb flailing for those ejections where the seat is pointing stably into the airstream. Such corrective action would not necessarily solve the limb flailing problem if the seat can acquire large angular spin rates, or a substantial angle of yaw to the flow. Author (GRA)

N72-15042*# Scripta Technica, Inc., Washington, D.C.
FUNCTIONAL EFFICIENCY OF THE VISUAL ANALYSOR DURING WORK WITH MICROSCOPES
N. I. Zoz *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 91-94 refs (See N72-15028 06-04)
Avail: NTIS CSCL 05E

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N72-15122 National Lending Library for Science and Technolcgy, Boston Spa (England).
REVIEW OF THE BOOK BY I. S. KULIKOV, "THERMAL DISSOCIATION OF COMPOUNDS"
Yu. A. Pavlov [1971] 6 p refs Transl. into ENGLISH from Stal' (Moscow), no. 8, 1971 p 695-696
(NLL-M-21204-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Thermodynamic characteristics for processes of thermal decomposition of various groups of compounds - oxides, sulphides, carbides, nitrides, borides, silicides and other substances are reported. On the basis of the thermo-dynamic analysis of binary and other complex systems over a wide range of temperatures, a method for the calculation of the composition of the vapor phase

and partial pressures of elements in chemical compounds is developed. The utilization of this method of thermodynamic calculation produces results which are in satisfactory agreement with experimental (mass-spectrographic) measurements. Author

N72-15123 National Lending Library for Science and Technology, Boston Spa (England).
THE STUDY OF A SINGLE CRYSTAL HIGH POLYMER
F. Hamada and A. Nakashima Nov. 1971 21 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 73, no. 7 p 73-81
(NLL-RTS-6687) Avail: Natl. Lending Library, Boston Spa, Engl.: £2.10; 7 NLL photocopy coupons

The fold surface structure and crystal condition in relation to the structure of single crystals of high polymers are discussed. There are many unresolved problems of the effect of sample molecular weight and distribution. Further investigations are also required of the process of lamella formation from solution and its structure. Author

N72-15124 National Lending Library for Science and Technology, Boston Spa (England).
THE TEMPERATURE DEPENDENCE OF THE ADHESION FORCE OF RUBBERLIKE POLYMERS TO HARD SURFACES
L. A. Akopyan and G. M. Bartenev Dec. 1971 5 p Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Ser. Tekh. Nauk (Yerevan), v. 22, no. 5, 1969 p 54-57
(NLL-RST-6899) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.50 or 2 NLL photocopy coupons

A method and a testing device were developed in which the normal contact pressure is removed during the process of determining the adhesion force. The time required to make a measurement and the time during which there is no normal contact pressure are both constant, and the influence of various factors on the adhesion force of polymers to hard surfaces is studied. As the temperature was raised, the specific adhesion force was found to increase linearly for a contact between rubber (copolymer of butadiene and 10% alpha-methyl styrene) and steel (roughness class 7 surface finish). This is attributed to the increase in actual contact area and to physicochemical reactions between the rubber and steel surface. N.E.N.

N72-15125# Eidgenossische Technische Hochschule, Zurich (Switzerland).
HIGH TEMPERATURE CHEMISTRY AND VALENCE PHASES OF IRON AND TITANIUM IN ALPHA-Al2O3 Ph.D. Thesis [HOCHTEMPERATURCHEMIE UND VALENZZUSTAENDE VON EISEN UND TITAN IN ALPHA-A1203]
Hans Kaspar Eigenmann 1970 115 p refs In GERMAN
(Diss-4552) Avail: NTIS

Spectroscopic and analytic studies on high temperature reduction chemistry of doped single crystals of the type Fe:Al203, Ti:Al203, and (Fe,Ti):Al203 are reported. Neutron activation and X-ray fluorescence methods produced concentration profiles and imbedding rates for iron and titanium. Electron spin resonance, infrared, and optical spectroscopy determined iron and titanium valencies in the oxidation as well as in the reduction phases. It is concluded that the blue color of the (Fe,Ti):Al203 single crystal results from the bi-particle (Fe,Ti)+6. Transl. by G.G.

N72-15126*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GENERAL CHEMICAL KINETICS COMPUTER PROGRAM FOR STATIC AND FLOW REACTIONS, WITH APPLICATION TO COMBUSTION AND SHOCK-TUBE KINETICS
David A. Bittker and Vincent J. Scullin Washington Jan. 1972 191 p refs
(NASA-TN-D-6586; E-5838) Avail: NTIS CSCL 07D

A general chemical kinetics program is described for complex, homogeneous ideal-gas reactions in any chemical system. Its main features are flexibility and convenience in treating many different reaction conditions. The program solves numerically the differential equations describing complex reaction in either a static system or one-dimensional inviscid flow. Applications include ignition and combustion, shock wave reactions, and general reactions in a flowing or static system. An implicit numerical solution method is used which works efficiently for the extreme conditions of a very slow or a very fast reaction. The theory is described, and the computer program and users' manual are included. Author

N72-15127*# Rocketdyne, Canoga Park, Calif.
NOVEL POLYMERS AND METHOD OF PREPARING SAME Patent Application
Stanley M. Hirshfield, inventor (to NASA) Filed 19 May 1971 19 p
(Contract NAS7-293)
(NASA-Case-NPO-10999; NASA-Case-NPO-10998; US-Patent-Appl-SN-145027) Avail: NTIS CSCL 07D

The utilization of lithium p-lithiophenoxide as an initiator in the preparation of functionally terminated star polymers is examined. The initiator, lithium p-lithiophenoxide, is used with monomers which are subject to anionic polymerization. When reacted with such materials a resulting polymer is formed having an -OLi grouping on one end and C-Li on the opposite end. When these functionally terminated polymers are reacted with suitable coupling agents (such as SiCl4) at the C-Li bond, a star polymer having an Si atom as the point of the star and terminated with -OLi groups is produced. The highly reactive functional -OLi or OH groups at the ends of the star polymer allow cross-linking through the use of simple difunctional agents. NASA

N72-15128*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POLYMERIZABLE DISILANOLS HAVING IN-CHAIN PERFLUOROALKYL GROUPS Patent Application
William J. Patterson and Donald E. Morris, inventors (to NASA) Filed 22 Dec. 1970 10 p
(NASA-Case-MFS-20979; US-Patent-Appl-SN-100774) Avail: NTIS CSCL 07D

The process and use of polymers prepared from disilanols are discussed. Such polymers show favorable properties as fuel tank sealers in hypersonic aircraft and reusable space shuttle vehicles. The polymers' favorable properties include superior resistance to hydrocarbon fuels, improved thermal stability, and minimum tendency to promote corrosion of the titanium alloys found in fuel tanks. E.H.W.

N72-15129*# Brown and Root, Inc., Houston, Tex.
ANTI-FOG COMPOSITION Patent Application
Dorrie L. Carmin, Jr. and Harry D. Morrison, inventors (to NASA) Filed 3 Sep. 1970 13 p
(Contract NAS9-7572)
(NASA-Case-MSC-13530-1; US-Patent-Appl-SN-69488) Avail: NTIS CSCL 07D

The development and chemical composition of a substance to prevent fogging of windows, space suit visors, and similar optical equipment are discussed. The materials consists of an alkyl glyceral sulfonate, water, and a time extender in the form of an oil. The materials is expected to prevent fogging of visual surfaces for periods of five hours or more during maximum metabolic loads. NASA

N72-15130# Joint Publications Research Service, Washington, D.C.
NEW PROPERTIES OF LIQUIDS
B. V. Deryagin and N. V. Churayev 18 Jan. 1972 175 p refs Transl. into ENGLISH of the book "Novyye Svoystva Zhidkostey" Moscow, Nauka, May 1971
(JPRS-54961; UDC-532.63) Avail: NTIS

The monograph deals with a number of new problems that have emerged in liquid state physics. Most of them are referable

to the discovery, investigation, and an effort to interpret an entirely new phenomenon: stable modified states of liquids and of water-II. Some original methods are described for investigation of the properties of this unique liquid thus far obtained in small quantities: viscosity, vapor pressure, density, refraction indices, and others. A bibliography listing 283 reference sources is included. Author

N72-15131# Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Film Dept.
POLYMER EMISSIVITY
F. P. Gay [1971] 20 p refs
Avail: NTIS

An understanding of the emissive behavior of plastics is needed to establish energy balances in hot systems. Results of an experimental examination of a polyimide based on 4,4'-diaminodiphenyl ether and pyromellitic anhydride are presented. Areas investigated were emissivity, how it behaves with temperature, how it behaves with receiving temperature and composition, and source of behavior. A.L.

N72-15132# Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Film Dept.
ORIENTATION STUDIES ON BIAXIALLY STRETCHED POLYPROPYLENE FILM
G. C. Adams 7 Sep. 1971 39 p refs
(Rept-302-W) Avail: NTIS

The development of planar (040) and (110) orientation as found in simultaneous biaxially stretched polypropylene film that has been quenched from the melt, reheated, and stretched was investigated. X-ray photographs and quantitative wide angle X-ray scans were used to explore the effects of biaxial stretch ratio and stretch temperature on the two orientation types mentioned. Author

N72-15133*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE PHOTOLYSIS OF CO2 AT 1849 AND 2139A
D. Krezenski, R. Simonaitis, and J. Heicklen 7 Oct. 1971 13 p refs
(Grants NGL-39-009-003; NSF GA-12385)
(NASA-CR-125423; PSU-IRL-SCI-374) Avail: NTIS CSCL 07D

The quantum yield for CO2 photodissociation at 25 C was found to be 1.08 + or - 0.12 for direct photolysis at 1849 A and between 200 and 800 torr; 0.48 + or - 0.02 for the Hg 6(1 P 1) sensitized decomposition between 130 and 730 torr; and 0.16 + or - 0.05 for the direct photolysis at 2139 A and between 300 and 600 torr. At these wavelengths, there was insufficient energy found to produce O(1 D). The primary process used is CO2 + hv yields CO + O(3 P). Author

N72-15134# Lockheed Missiles and Space Co., Palo Alto, Calif.
PHOTOCHEMICAL PROCESSES IN THE PHOTOLYSIS OF O2 AND O2 PLUS M MIXTURES, WHERE M EQUALS He, Ar, Xe, N2, CO2
A. M. Privalov, L. G. Karpov, and F. I. Vilesov [1971] 7 p refs Transl. into ENGLISH from Khim. Vys. Energ. (Leningrad), v. 5, no. 5, 1971 p 388-392
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An analysis is made of reactions possible in the photolysis of O2 plus M mixtures. A mechanism is proposed which permits calculation of the magnitude of the absolute quantum yield of ozone formation for its low concentrations. The value of the O3 concentration for photochemical equilibrium of the mixture O2 plus O3 plus M is determined. M mixtures are defined as He, Ar, Xe, N2 and CO2. Author

N72-15135# Aktiebolaget Atomenergi, Studsvik (Sweden).
IN-LINE DETERMINATION OF CORROSION RATES IN HIGH TEMPERATURE ENVIRONMENTS BY THE LINEAR POLARIZATION METHOD
Walter Huebner 1971 11 p refs Presented at 6th Scand. Corrosion Congr., Gothenburg, Sweden, 24 May 1971
(Conf-710520-2) Avail: AEC Depository Libraries

A brief survey is given of corrosion rate measurements by means of linear polarization measurements. Equipment for electrochemical measurements at high temperature by polarization was studied in a series of tests in water at 250 C for carbon steel at pH 3 and pH 7.5 and for stainless steel at pH 7.5. IR-drops due to resistance polarization were eliminated by a bridge circuit. Transient techniques were used in order to minimize the time necessary for measurements. Tafel constants were determined by polarization in the logarithmic range, and corrosion currents were also obtained by extrapolation to the corrosion potential. Using the experimentally determined Tafel constants, the corrosion currents as a function of time were calculated from the slope in the linear polarization region. The corrosion rates thus obtained were compared with measurements of descaled weight loss, reasonable agreement being found. Author (NSA)

N72-15136# Saint Procopius Coll., Lisle, Ill.
[IONIZATION MEASUREMENTS IN GASES AND VAPORS] Progress Report
2 Jun. 1971 9 p
(Contract AT(11-1)-323)
(COO-323-18) Avail: NTIS

The design of a high-temperature chamber for ionization measurements is described, and preliminary ionization studies of mercury vapor and mixtures of argon and mercury vapor are discussed. NSA

N72-15137# Avco-Everett Research Lab., Everett, Mass.
MEASUREMENTS IN ABLATING AIR TEFLON BOUNDARY LAYERS
John H. Chang (TRW Systems Group, Redondo Beach, Calif.) and R. E. Center Sep. 1971 30 p refs
(Contract F04701-71-C-0033; ARPA Order 1092)
(AD-730596; AERL-RR-369; SAMSO-TR-71-144) Avail: NTIS CSCL 07/4

Theoretical descriptions of the detailed structure of ablating air-Teflon laminar boundary layer predict CF2 to be a major constituent in the boundary layer. This species has not been observed experimentally. This paper presents spectrally and spatially resolved UV thermal radiation measurements which demonstrate the presence of CF2 in the stagnation point boundary layer of ablating Teflon cylinder. The experiments were performed in an arc facility which provided subsonic air or nitrogen jets at 2500 to 4500K and 1/40 atmospheric pressure. The state of the freestream was measured by the electron beam fluorescence technique. Author (GRA)

N72-15138# Naval Air Development Center, Johnsville, Pa. Aero Materials Dept.
A SURVEY OF AIRCRAFT MAINTENANCE CHEMICALS SUSPECTED OF CONTRIBUTING TO WATER POLLUTION
Jack Smith 23 Aug. 1971 15 p refs
(WF Proj. 51-543-202)
(AD-730473; NADC-MA-7153) Avail: NTIS CSCL 11/11

The composition of chemical materials commonly used in the maintenance of naval aircraft was studied in order to determine the presence of ingredient chemicals known or suspected to contribute to water pollution. This information may be used to reduce the pollutants by reformulation where and whenever effective non-polluting substitutions can be made or as a means of determining safe methods of disposal. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N72-15139 British Broadcasting Corp., Kingswood (England). Research Dept.
TROPOSPHERIC RADIO WAVE PROPAGATION OVER IRREGULAR TERRAIN: THE COMPUTATION OF FIELD STRENGTH FOR UHF BROADCASTING
J. H. Causebrook and B. Davis Nov. 1971 16 p refs
(BBC-1971/43; UDC-621.391.812.8) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Techniques are described for application in a digital computer program to calculate the field strength of UHF transmitters, with a particular emphasis on the determination of field at long distances which may cause a co-channel interference limitation to a broadcast service. Theoretical calculation methods for certain idealized conditions are specified and proposals made for their application to practical conditions of propagation over irregular terrain. The influence of tropospheric conditions is considered, and means of deriving factors which must be determined from empirical evidence are indicated. Recognition is given to the fact that any system is liable to suffer from a lack of radio and geographical data, and the methods devised are those using a practical amount of such data. Author

N72-15140# Xonics, Inc., Van Nuys, Calif.
VORTEX OBSERVATIONS BY THE XONICS ACOUSTIC RADAR AT NAFEC Final Report
Martin Balster, Arthur E. Nagy, and Andrew P. Proudian Dec. 1971 122 p
(Contract DOT-FA71WA-2672)
(TR-7; FAA-RD-71-103) Avail: NTIS

A series of flight tests was conducted in order to demonstrate feasibility of the concept of the acoustic 'vortex detector. The first tests consisted of simultaneous observations in close proximity by both the detector equipment and the instrumented tower of vortices shed by a low-flying aircraft. Except for the few cases where data was lost through equipment misalignment or malfunction or operator error, vortex returns were observed on virtually all of the runs. A total of 55 runs, which represents a substantial fraction of all of the data gathered, were selected for analysis. The vortex velocity measurements exhibit a clear correlation with aircraft configuration, and appear to confirm their use as a valid indicator or vortex intensity. Tests were run to demonstrate the tracking capability of the acoustic sensor. Two principal modes of operation were employed, and many variations of equipment parameters were tested within each of them. Successful tracks were obtained in both modes, and a number of samples are presented. Strong signals leading to good tracks were observed for a nominal aircraft height of 800 ft., but returns were unaccountably weak and sporadic for aircraft height of 1000 and 1200 ft. An analysis is given of the enhanced system performance that is probably required to achieve confident tracking at altitudes up to 1700 ft. Author

N72-15141*# Techtran Corp., Glen Burnie, Md.
ACROSS THE ATLANTIC: CABLES VERSUS SATELLITES
Dominique Verguese and Polen Lloret Washington NASA Jan. 1972 18 p ref Transl. into ENGLISH from Le Monde (Paris), 1 Dec. 1971 p 18-19
(Contract NASw-2037)
(NASA-TT-F-14115) Avail: NTIS CSCL 17B

Forecasts are made for future use and comparative costs of satellite and cable communication. While all judgements are tentative, satellites seem cheaper if used to full extent. It is concluded, however, that cables will continue to be used to keep up competition in pricing, and for special purposes, i.e., cable TV. Author

N72-15142*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STATION TO INSTRUMENTED AIRCRAFT L-BAND TELEMETRY SYSTEM AND RF SIGNAL CONTROLLER FOR SPACECRAFT SIMULATIONS AND STATION CALIBRATION
Charles A. Scaffidi, Frank J. Stocklin, and Michael B. Feldman Aug. 1971 50 p
(NASA-TM-X-65798; X-511-71-520) Avail: NTIS CSCL 17B

An L-band telemetry system designed to provide the capability of near-real-time processing of calibration data is described. The system also provides the capability of performing computerized spacecraft simulations, with the aircraft as a data source, and evaluating the network response. The salient characteristics of a telemetry analysis and simulation program (TASP) are discussed, together with the results of TASP testing. The results of the L-band system testing have successfully demonstrated the capability of near-real-time processing of telemetry test data, the control of the ground-received signal to within + or - 0.5 db, and the computer generation of test signals. Author

N72-15143# Lockheed Missiles and Space Co., Palo Alto, Calif.
RESOLUTION OF RADAR SIGNALS
V. V. Grigorin-Riabov, ed. [1971] 33 p refs Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, Moscow, 1970 p 167-215
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Resolution is among the most important of the tactical indices of radars. Quantitatively it is estimated by the minimal difference between the coordinates or velocities of two targets. How the magnitude of resolution can be improved and the factors and technical parameters of the radar on which it depends are discussed. A.L.

N72-15144# Environmental Research Corp., Las Vegas, Nev.
BASIC ELEMENTS OF TWO-DIMENSIONAL WAVE PROPAGATION IN HOMOGENEOUS ISOTROPIC LAYERED ELASTIC MEDIA
F. W. Power and R. A. Mueller Aug. 1971 26 p refs Sponsored by AEC
(NVO-1163-TM-28) Avail: NTIS

The boundary value problem of a spherically symmetric forcing function acting at an elastic radius in a layered half-space in which the layers are taken to be isotropic and elastic is formulated for two dimensional geometry. The basic elements of the theory are developed for completeness with the solution presented in finite difference form. The boundary value problem is modified so as to apply to underground nuclear detonations in either a halfspace or a layered half-space and subsequently coded for digital computation. Utility of the finite difference wave propagation computer code (SHELP) for various ground motion studies is described. Author (NSA)

N72-15145# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
STOCHASTIC SPACES
D. I. Blokhintsev 1971 13 p refs
(JINR-E2-5922) Avail: AEC Depository Libraries

The phase fluctuations of the wave propagating in a stochastic homogeneous medium, particularly in a physical vacuum, are calculated. The notion of stochastic space is introduced. It is shown that to obtain covergent results in the relativistic case it is necessary to introduce a cut-off factor. Author (NSA)

N72-15146# Bendix Corp., Kansas City, Mo.
VISUAL AND ELECTRICAL INSPECTION OF MINIATURE RADARS Final Report
Walter P. Beck Jul. 1971 78 p
(Contract AT(29-1)-613)
(BDX-613-451) Avail: NTIS

Development of inspection techniques for miniature electronic assemblies included consideration of a scanning electron microscope for in-process inspection, determination of accuracies that can be maintained in drilling pc boards, establishment of component identification methods which are less dependent upon markings, consideration of visual-defect histories as guides for electronic packaging, setting guidelines for mechanical piecepart tolerances, and definition of inspection requirements for microcircuit assemblies. A piecepart tolerance guide and a preliminary inspection outline were developed. The inspection outline will provide a checklist for Bendix microcircuits as that technology advances. Author

N72-15147# Institut fuer Informationsverarbeitung in Technik und Biologie, Karlsruhe (West Germany).
INVESTIGATIONS OF PROPERTIES OF PARALLEL PROCESSING NETWORKS WITH FORWARD COUPLING USING A NEURON NETWORK MODEL [UNTERSUCHUNGEN UEBER DIE EIGENSCHAFTEN PARALLELVERARBEITENDER NETZE MIT VORWAERTSKOPPLUNG AN HAND EINES NEURONENNETZMODELLS]
Peter Rudolph Bonn Bundeswehramt 1971 157 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-71-14) Avail: NTIS; Bundeswehramt: 25 DM

The properties of parallel processing networks with forward coupling are analyzed by means of a neuron network model that largely represents the functional characteristics of neuron networks. The specific properties of the network elements, especially the threshold, lead to nonlinear behavior of the network. When locally distributed patterns are transmitted the threshold only permits the intensified parts of them to pass to the outputs of the network. This property can be utilized for the separation of intermixed patterns. Beyond this, neuron networks are suitable for detection of patterns in the presence of locally distributed disturbances. With regard to simple problems, linear and nonlinear detection systems can be realized with a quality that differs only slightly from that of the appropriate optimal system. Author (ESRO)

N72-15148# Signals Research and Development Establishment, Christchurch (England).
AN ERROR DATA LOGGER
N. R. Polden Nov. 1970 52 p refs
(SRDE-70062) Avail: NTIS

A device is described which will count the number of input pulses occurring during a selected period and print the result on a teleprinter at the end of the period. It will interface directly with a data transmission test set, and thus can be used for continuous monitoring of errors occurring on digital data links at data rates of up to 4800 bauds. The teleprinter output is in International Telegraph Alphabet No. 2 teleprinter code at 50 or 75 bauds, and the punched tape output can be fed directly into a computer for analysis of large quantities of data.
Author (ESRO)

N72-15149# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
A NEW APPROACH TO DISTORTION AND NOISE PROBLEMS IN AM/FM TELEMETRY SYSTEMS ESPECIALLY BY LINEARIZING OF THE FM TRANSMISSION SYSTEM AND BY AUTOMATIC CONTROL OF THE FREQUENCY DEVIATION Ph.D. Thesis - Brunswick Univ. [UEBER DIE VERBESSERUNG DER STOERABSTAENDE VON AM/FM TELEMETRIEANLAGEN INSBESONDERE DURCH LINEARISIERUNG DES FMUEBERTRAGUNGSSYSTEMS UND DURCH REGELUNG DES FREQUENZHUBES]
W. Schneider 1971 161 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-35) Avail: NTIS; DFVLR, PORZ: 34 DM

Problems in arranging subcarrier frequencies, drift in transmission channels, nonlinear distortions in FM transmission systems and in imporving the average deviation of the FM-transmitter are investigated, in order to obtain a higher accuracy of transmission with AM/FM-telemetry system. These studies lead to a better frequency allocation for subcarrier frequencies. Drift in transmission channels and a special term of third order distortions are reduced with the aid of a reference subcarrier and a quotient circuit in the receiving station. The average deviation of the FM-transmitter is improved by automatic gain control of the mean of the baseband. The nonlinear distortions of a FM-transmission system are reduced by a circuit, which is able to linearize nonlinear systems, both with and without memory. With this approach, transmission errors in an AM/FM-system can be substantially reduced. Author (ESRO)

N72-15150# Royal Aircraft Establishment, Farnborough (England).
AN ANALOGUE TO DIGITAL CONVERTER FOR SPACECRAFT TELEMETRY
L. Smith and P. Clarkson May 1971 41 p ref
(RAE-TR-71099) Avail: NTIS

A prototype analog to digital converter for use in spacecraft PCM telemetry is described. The converter uses mainly digital integrated circuits, and gives both a parallel and serial output without the need for additional circuitry. It can be modified readily to accommodate increased accuracy and speed of conversion, with minimal circuit redesign. The design, construction, and testing are reported. A prototype achieved a conversion accuracy of better than 1% with conversion rates of 5000 samples per second over the temperature range from -20 to 70 C. ESRO

N72-15151# Illinois Univ., Urbana. Aviation Research Lab.
TIME-COMPRESSED DISPLAYS FOR TARGET DETECTION M.S. Thesis
Lawrence A. Scanlan May 1971 83 p refs
(Contract F44620-70-C-0105; AF Proj. 9778)
(AD-731136; ARL-71-9/AFOSR-71-2; AFOSR-71-2598TR) Avail: NTIS CSCL 17/9

Previous research has demonstrated that there is a gain in radar target detection performance when coherent target motion is accentuated by time-compressing the presentation of displayed images from successive scans of the antenna. However, a need exists for information concerning effects of numerous time-compression variables upon detection performance and how these variables interact with one another. In addition, time-compression phenomena must be related to our knowledge of the human perceptual process. The experiment described investigated the effects of time-compression ratio, number of stored frames, clutter level, noise level, target direction, and target speed and various interactions among these variables. The results are discussed in terms of existing theories of visual perception. Author (GRA)

N72-15152# Michigan State Univ., East Lansing. Div. of Engineering Res.
MODIFICATION OF EM SCATTERING FROM A THICK CYLINDER BY MULTI-SLOT IMPEDANCE LOADING
John R. Short and Kun-Mu Chen Jul. 1971 112 p refs
(Contract F19628-70-C-0072; AF Proj. 5635-02-01)
(AD-731180; AFCRL-71-0445) Avail: NTIS CSCL 20/14

The modification and control of the scattering of a plane electromagnetic wave by a thick, conducting, infinitely long cylinder loaded with several impedance-backed longitudinal slots is investigated. The incident plane wave is polarized with its electric field vector perpendicular to the cylinder axis. The slots are electrically narrow and the electric fields across them are

assumed to be constant. Within this assumption an exact theory is developed. Synthesis procedures are developed to find load impedances and purely reactive load impedances that cause the scattered field to vanish in one or more desired directions. Synthesis procedures are also developed for finding a single purely reactive load impedance that produces minimum scattering in one direction and load impedances which result in zero scattering in one direction at several frequencies. The frequency dependence and bandwidths of the different loadings are also considered. Extensive numerical results are presented. The theoretical predictions are confirmed with an experiment.
Author (GRA)

N72-15153# Air Force Cambridge Research Labs., Bedford, Mass.
AFCRL LIMITED WAR EFFORT TASK NO. 24: SATELLITE BEACON STUDIES IN THE PANAMA CANAL ZONE Air Force Surveys in Geophysics
John P. Mullen 6 Aug. 1971 22 p refs
(AF Proj. 4643)
(AD-731171; AFCRL-71-0423; AFCRL-AFSIG-235) Avail: NTIS CSCL 20/14

During the period 1 December 1967 to 1 December 1970, a simulated satellite terminal was operated in the U.S. Army Tropic Test Center, Panama Canal Zone. The project has two objectives: determination of ionospheric effects at VHF and determination of foliage effects on satellite signals at very high frequencies (VHF). By far the majority of the effects observed were attributed to the former cause. Diffraction by ionospheric irregularities on specific nights caused fading of up to 16 dB peak to peak. During the day and other nights, no appreciable fading was observed. While a sample of 1000 hours taken over summer and fall of 1968 yielded a scintillation probability of occurrence of 3.15%, a smaller sample (369 hours) taken during the vernal equinox of 1970 yielded almost three times that probability. It is suggested that during the declining portion of the sunspot cycle the equatorial scintillation region moves northward. Total electron content is computed and its importance in measuring radar range error is noted. Author (GRA)

N72-15154# New Mexico Univ., Albuquerque. Office of Research Services.
RADIATION FROM DIELECTRIC LOADED WAVEGUIDE FED APERTURE ANTENNAS Technical Report, May 1968 - Jul. 1969
Martin D. Bradshaw Sep. 1971 171 p refs
(Contract F29601-68-C-0089; AF Proj. 5791)
(AD-731292; AFWL-TR-71-110) Avail: NTIS CSCL 20/14

Theoretical and experimental studies of the radiation pattern and input admittance of dielectric loaded waveguide fed aperture antennas are presented. The model consists of a waveguide fed, dielectric loaded aperture whose outer surface is flush with an infinite, perfectly conducting ground plane. The aperture and ground plane are covered by a dielectric layer. The window and the covering layer may be inhomogeneous in the direction of propagation. The analysis makes use of a mode-matching process that permits the effects of higher order modes to be taken into account in the dielectric loaded aperture section and in the covering layer. The window and layer are represented by an arbitrary number of inhomogeneous, lossy, dielectric slabs, each with slightly different permittivities. Collection (point-matching) techniques are used to match boundary conditions at each interface within the dielectric loaded aperture section and two-dimensional Fourier transforms are used to match boundary conditions at each interface in the covering layer. Matrix techniques are used to handle an arbitrary number of layers in either region. A large number of experimental measurements of input admittance and far-field radiation pattern measurements are presented for three different aperture configurations, with and without a covering dielectric layer. A computer program is described that can handle the computations. The program is written in FORTRAN IV for a Control Data Corporation 6600 machine. Computed values of input admittance and far-field radiation patterns are presented. Author (GRA)

N72-15155# Syracuse Univ. Research Corp., N.Y.
HF ANTENNA PROGRAM Final Report, 15 May 1970 - 31 May 1971
Richard G. Russell Jun. 1971 201 p refs
(Contract N00014-70-C-0348)
(AD-731406; SURC-TR-71-169) Avail: NTIS CSCL 09/5

An HF receiving antenna system for use with USMC Surveillance Systems was designed and fabricated. Antenna pattern measurements were taken on the SURC antenna test range. The formulated electrical design is included. Recommendations, including service testing, were made. Author (GRA)

N72-15156# Stanford Research Inst., Menlo Park, Calif.
EMERGENCY COMMUNICATION CHANNEL UTILIZATION Final Report
Chester A. Hall, Jr. Jul. 1971 147 p refs
(Contract DAHC20-67-C-0136; SRI Proj. 6300-740)
(AD-731289) Avail: NTIS CSCL 17/2

The impact of heavy congestion on civil defense emergency radio communication channels can be reduced by careful, enlightened advance planning and actions. This study examines the civil defense portions of the electromagnetic spectrum and pertinent characteristics, equipment parameters, network types, current procedures and constraints, and defines the actions required prior to an emergency and actions during emergencies, to include monitoring techniques. Author (GRA)

N72-15157# Harvard Univ., Cambridge, Mass. Cruft Lab.
EXPERIMENTAL STUDY OF COUPLED THICK ANTENNAS
Bob M. Duff Jul. 1971 96 p refs
(Contract F19628-68-C-0030; AF Proj. 5635)
(AD-731179; SR-12; AFCRL-71-0440) Avail: NTIS CSCL 09/5

The results of an experimental study of two identical, parallel, nonstaggered thick antennas are presented in this report. The term thick antenna means a cylindrical dipole whose radius is significant compared to the free space wavelength of the exciting signal. Three thicknesses of antenna were used in the experiment: ka – 0.318, 0.639, and 0.877. Measurements were made of the apparent input admittance for both symmetric and antisymmetric drive, from which apparent self- and mutual admittances were computed. Both axial and transverse components of the current on the surface of the antennas were measured as functions of the cylindrical coordinates phi and z associated with the antenna. A complete description is given of the experimental system including the design of the antenna system, the arrangement for driving the antennas, a description of the measuring system, and a discussion of some of the problems encountered in carrying out the measurements. The variations of self- and mutual admittance as a function of spacing between antennas is shown with comparison to the behavior of thin antennas. Available theoretical results for the current distribution on coupled thick antennas are compared with the measured current distributions. Author (GRA) 2

N72-15158# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
A PROGRAM FOR COMPUTING NEAR FIELDS OF THIN WIRE ANTENNAS
Dah-Cheng Kuo and Bradley J. Strait 15 Sep. 1971 43 p refs
(Contract F19628-68-C-0180; AF Proj. 5635-06-01)
(AD-731178; SR-14; AFCRL-71-0463) Avail: NTIS CSCL 09/2

A user-oriented computer program is presented and described for analyzing the near fields of thin wire antennas. The program is based on the method of moments and is an extension of a program presented earlier for computing far-field and current distributions. In general the wires of a given configuration can be arbitrarily bent and can be excited or loaded at arbitrary points along their lengths. It is also possible to include wire junctions enabling treatment of special configuretions such as wire crossed and supporting wires for long antennas. The subsectional approach used provides accurate results as close as one subsection length from the nearest wire surface. Author (GRA)

N72-15159# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
PROJECT RATRAN: RESEARCH ON THE ESTIMATION OF TRAJECTORIES FROM RADAR DATA Quarterly Progress Report, 1 May - 31 Jul. 1971
Raymond S. Berkowitz, M. Plotkin, and D. Luber Oct. 1971 20 p refs
(Contract DAAB07-71-C-0212; DA Proj. 1S6-63719-DK-72)
(AD-731499; ECOM-0212-1; QPR-1) Avail: NTIS CSCL 17/9

In this first quarterly progress report initial efforts in pursuance of project objectives are described. Section 1 gives a statement of work objectives and a brief summary of accomplishments so far. Section 2 presents a general classification of system errors that must be considered. The need for simplified-dynamics equations is discussed in Section 3. Section 4 describes procedures to be used in evaluating optimal filtering errors. Section 5 reviews techniques for filtering and describes the approach being taken for design of the required filter algorithm. Conclusions and plans for future work are in Section 6 and a list of significant references used is given in Section 7.
Author (GRA)

N72-15160# Michigan State Univ., East Lansing. Div. of Engineering Research.
INVESTIGATION OF IMPEDANCE LOADED SLOT ANTENNAS
Tsing-Zone Hsieh, Dennis P. Nyquist, and Kun-Mu Chen Jul. 1971 145 p refs
(Contract F19628-70-C-0072; AF Proj. 5635)
(AD-730616; AFCRL-71-0397; SR-3) Avail: NTIS CSCL 09/5

A simple, flush-mounted antenna consists of a slot cut in a ground plane and excited by a potential maintained between its edges at a point along its axis. The circuit and radiation properties of electrically small slot antennas doubly loaded by lumped impedances connected between their edges are investigated. In the theoretical investigations, integral equations for the electric field distributions excited in the impedance loaded slots by a delta-function current source are formulated and solved numerically. In terms of these slot fields, the input impedances and the radiation fields of the loaded slot antennas are calculated. These analytical results are confirmed qualitatively by those of complementary experimental studies. It is demonstrated that the electrically small slot can be forced into a near antiresonant condition by the selection of an optimum purely reactive loading. A large input resistance is subsequently obtained. This optimum reactance is found to be usually capacitive while the antenna input impedance is inductive. Low loss capacitive loading and tuning impedances can thus be utilized to implement a high efficiency, small antenna. A second optimum reactance loading leads to radiation field patterns which can be highly directive in the case of the rectangular slot or greatly modified for the annular slot radiator. Author (GRA)

N72-15161# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Electrical Engineering.
A STUDY OF THE EFFECT OF SAMPLE DEPENDENCE AND SAMPLE SIZE ON SOME NONPARAMETRIC SIGNAL DETECTORS
Samuel V. Whitten, Jr. and M. Arozullan Sep. 1971 84 p refs
(Contract N00014-70-A-0311-0002; NR Proj. 042-274)
(AD-730507; TR-71-1) Avail: NTIS CSCL 09/4

The effect of sample dependence and size (in terms of probability of error) on the performance of m-ary optimum Gaussian, Mann-Whitney, and Sign detectors was evaluated under Gaussian and Cauchy (jamming) noise environments. The evaluation was performed by a hybrid simulation of a communication system with facility to vary the sampling rate. An increasing energy, ternary signal set was used. In strong additive Gaussian noise the frequency of error of the detectors was evaluated for various degrees of sample dependencies and a number of sample sizes. It is shown that a tradeoff can be established between sample size and dependence for the Mann-Whitney and the optimum Gaussian detectors. It was concluded that for a fixed signaling interval, a smaller number of less dependent samples should be taken, rather than a large number of heavily dependent ones. A criterion was determined for choosing between the two alternatives for the detectors studied. Author

N72-15796# Siemens A.G., Munich (West Germany). Zentrallab. fuer Nachrichtentechnik.
THE EFFECT OF ELECTROMAGNETIC ENVIRONMENTAL CONDITIONS ON THE TRANSMISSION OF ELECTRIC SIGNALS WITH SPECIAL REFERENCE TO DATA TRANSMISSION
W. Vogl and E. Popp *In* Soc. of Environ. Engr. Environ. Eng. 1970 13 p (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

N72-15341# Imperial Coll. of Science and Technology, London (England).
A THEORY OF VLF EMISSIONS
D. Nunn *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 17-33 refs (See N72-15339 06-13)
Avail: NTIS

N72-15342# Groupe de Recherches Ionospheriques, Paris (France).
QUASI LINEAR CALCULATION OF VLF HISS SPECTRUM
J. Etcheto, A. Roux, R. P. Singh, and J. Solomon *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 37-40 refs (See N72-15339 06-13)
Avail: NTIS

N72-15343# European Space Research and Technology Center, Noordwijk (Netherlands).
RECENT WORK ON ION-CYCLOTRON WHISTLERS
Dyfrig Jones *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 43-62 refs (See N72-15339 06-13)
Avail: NTIS

N72-15348# Sheffield Univ. (England). Dept. of Physics.
STUDIES OF VLF EMISSIONS IN THE SATELLITE ARIEL 3
T. R. Kaiser *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 109-121 refs (See N72-15339 06-13)
Avail: NTIS

N72-15352# Sheffield Univ. (England). Dept. of Physics.
***MAGNETOSPHERIC STRUCTURE DEDUCED FROM* WHISTLER OBSERVATIONS AT HALLEY BAY**
J. L. Sagredo and K. Bullough *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 157-161 refs (See N72-15339 06-13)
Avail: NTIS

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N72-15162 National Lending Library for Science and Technology, Boston Spa (England).
SIMULATING OPERATING PRIORITIES ON THE CDC 6600 COMPUTER
G. Reinier 6 Dec. 1971 131 p Transl. into ENGLISH from

Bull. Dir. Etud. Rech., Ser. C (France), no. 2, 1970 p 97-170 (NLL-CE-Tr-5639-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 8 NLL photocopy coupons

The effects of priority disciplines on CDC 6600 computer efficiency are discussed. Because a direct study is too complex, the only possible approach is by simulation. Among all the possible rules, only those related to operating systems Scope 2 and Scope 3, have been chosen. With these mathematical models of the computer, and after a study of the units in the queues, methods to calculate delay-time can be established. Simulation can also be resorted to in approaching many other aspects of the computer, for example to determine its possibilities with either hardware or software modifications. Author

N72-15163# Japan Broadcasting Corp., Tokyo. Auditory and Visual Information Processing Research Group.

ELECTRONIC RETINA

Yukiya Yamaguchi and Shojiro Nagata Mar. 1971 14 p refs (NHK-Labs-Note-141) Avail: NTIS

Design and construction of an experimental electronic retina model is reported. Employed is a novel construction technique for the interconnection between the neuron layers where the input connections per neuron are far less than 100. The model consists of about 700 photoreceptors and the same number of output cells, both arranged as two-dimensional arrays. An output cell is an abstract neuron which acts on the analog quantity of input and output. The interconnections between photoreceptors and output cells are made through two impedance mesh layers, one for the excitatory connection and the other for the inhibitory connection. The combined connections create on-center type receptive fields at the output. Author

N72-15164*# Texas A&I Univ., Kingsville. Dept. of Mathematics.

INVESTIGATION OF THE SPECHT DENSITY ESTIMATOR

F. M. Speed and L. M. Rydl Jul. 1971 32 p (Grant NGR-44-073-003)

(NASA-CR-115306; TR-3) Avail: NTIS CSCL 09B

The feasibility of using the Specht density estimator function on the IBM 360/44 computer is investigated. Factors such as storage, speed, amount of calculations, size of the smoothing parameter and sample size have an effect on the results. The reliability of the Specht estimator for normal and uniform distributions and the effects of the smoothing parameter and sample size are investigated. Author

N72-15165# Rice Univ., Houston, Tex. Dept. of Mechanical and Aerospace Engineering and Materials Science.

USE OF THE AUGMENTED PENALTY FUNCTION IN MATHEMATICAL PROGRAMMING PROBLEMS. PART 2: CONJUGATE GRADIENT-RESTORATION ALGORITHM

A. Miele, E. E. Cragg, and A. V. Levy 1971 36 p refs (Grant NSF-GP-27271)

(AAR-84-Pt-2) Avail: NTIS

The problem of minimizing a function f(x) subject to a constraint phi(x) = 0 is considered. The use of the augmented penalty function is explored in connection with the conjugate gradient-restoration algorithm. The conjugate gradient-restoration algorithm includes a conjugate gradient phase involving n-q iterations and a restoration phase involving one iteration. In the conjugate gradient phase, improvement in the value of the function is sought, while avoiding excessive constraint violation. In the restoration phase, constraint error is reduced, while avoiding excessive change in the value of the function. Five numerical examples are developed. The first refers to a quadratic function and a linear constraint. The remaining examples refer to nonquadratic functions and nonlinear constraints. For the linear-quadratic examples, all algorithms behave identically, as was predicted by the theory. For the nonlinear-nonquadratic examples, algorithms of class 2 generally exhibit faster convergence than algorithms of class 1 and algorithms of type beta generally exhibit faster convergence than algorithms of type alpha. Author

N72-15166# Central Statistical Administration, Moscow (USSR).

COMPUTER ANALYSIS OF STATISTICAL DATA

Ya. L. Tipis and V. V. Braga 1971 191 p refs In RUSSIAN Avail: NTIS

Ways and means of setting up machine systems for statistical information handling are considered, including the problems involved, from design to automation. The first Russian attempt in this area is discussed. Flow diagrams and the different forms and types of data applicable are presented. Projected mechanization for card punching, primary and resultant documentation on automation, establishing a nomenclature of codes and ciphers, and the structure of a technological process are among the topics considered. Transl. by K.P.D.

N72-15167*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MISSION AND DATA OPERATIONS IBM 360: USER'S GUIDE

Jack Balakirsky (Computer Sciences Corp., Silver Spring, Md.) Sep. 1971 482 p refs

(NASA-TM-X-68807) Avail: NTIS HC $6.00/MF $0.95 CSCL 09B

The purpose of this manual is to serve as an introduction to the M&DO computer systems and to supplement all other relevant documentation to be referenced. Because of its index structure, the user will be able to reference those sections pertinent to his needs. This is not a programming manual; where a user needs to learn a language or a system, it will be necessary to review the referenced documents. Author

N72-15168*# Martin Marietta Corp., Denver, Colo.

DEVELOPMENT OF A TEST AND FLIGHT ENGINEERING ORIENTED LANGUAGE. PHASE 1: ORAL PRESENTATION MATERIAL

W. F. Kamsler, C. W. Case, E. L. Kinney, and J. Gyure Aug. 1970 48 p (Contract NAS10-7308)

(NASA-CR-125312; MCR-70-339) Avail: NTIS CSCL 09B

The material used in an oral presentation of the phase 1 study effort is given. Phase 1 was directed at the examination of existing related languages and their applications. D.L.G.

N72-15169#* Martin Marietta Corp., Denver, Colo.

DEVELOPMENT OF A KSC TEST AND FLIGHT ENGINEERING ORIENTED COMPUTER LANGUAGE, PHASE 1 Interim Report, Jul. - Aug. 1970

C. W. Case, E. L. Kinney, and J. Gyure Aug. 1970 74 p refs (Contract NAS10-7308)

(NASA-CR-125260; MCR-70-327) Avail: NTIS CSCL 09B

Ten, primarily test oriented, computer languages reviewed during the phase 1 study effort are described. Fifty characteristics of ATOLL, ATLAS, and CLASP are compared. Unique characteristics of the other languages, including deficiencies, problems, safeguards, and checking provisions are identified. Programming aids related to these languages are reported, and the conclusions resulting from this phase of the study are discussed. A glossary and bibliography are included. For the reports on phase 2 of the study, see N71-35027 and N71-35029. Author

N72-15170*# Martin Marietta Corp., Denver, Colo.

DEVELOPMENT OF A TEST AND FLIGHT ENGINEERING ORIENTED LANGUAGE. PHASE 3: PRESENTATION

W. F. Kamsler, C. W. Case, E. L. Kinney, and J. Gyure Dec. 1970 104 p (Contract NAS10-7308)

(NASA-CR-125313; MCR-70-425) Avail: NTIS CSCL 09B

The format material used in an oral presentation of the phase 3 study effort is given. The material includes a description of the language ALOFT and a terminology comparison with other test languages. D.L.G.

N72-15171*# Martin Marietta Corp., Denver, Colo.
DEVELOPMENT OF A TEST AND FLIGHT ENGINEERING ORIENTED LANGUAGE, PHASE 3 Technical Report, Oct. - Dec. 1970
W. F. Kamsler, C. W. Case, E. L. Kinney, and J. Gyure Dec. 1970 96 p
(Contract NAS10-7308)
(NASA-CR-125314; MCR-70-424) Avail: NTIS CSCL 09B

Based on an analysis of previously developed test oriented languages and a study of test language requirements, a high order language was designed to enable test and flight engineers to checkout and operate the proposed space shuttle and other NASA vehicles and experiments. The language is called ALOFT (a language oriented to flight engineering and testing). The language is described, its terminology is compared to similar terms in other test languages, and its features and utilization are discussed. The appendix provides the specifications for ALOFT.
Author

N72-15172# National Engineering Lab., Glasgow (Scotland).
AUTOMATIC TEMPERATURE MONITORING IN A LARGE CREEP LABORATORY
D. M. Bradley and I. C. Craik Mar. 1971 24 p refs
(NEL-480) Avail: NTIS

A system is described which reduces the time spent on data collection and assesses qualitatively, by means of histograms, the standard of temperature control achieved in 250 tests. The main features of the automatic data logger and the suite of computer programs which it feeds are described using flow charts.
Author

N72-15173*# General Applied Science Labs., Inc., Westbury, N.Y.
CALCULATION OF TURBULENT BOUNDARY LAYERS WITH HEAT TRANSFER AND PRESSURE GRADIENT UTILIZING A COMPRESSIBILITY TRANSFORMATION. PART 3: COMPUTER PROGRAM MANUAL
J. Schneider and J. Boccio Washington NASA Jan. 1972 97 p refs
(Contract NAS1-9624)
(NASA-CR-1925; GASL-TR-748-Pt-3) Avail: NTIS CSCL 09B

A computer program is described capable of determining the properties of a compressible turbulent boundary layer with pressure gradient and heat transfer. The program treats the two-dimensional problem assuming perfect gas and Crocco integral energy solution. A compressibility transformation is applied to the equation for the conservation of mass and momentum, which relates this flow to a low speed constant property flow with simultaneous mass transfer and pressure gradient. The resulting system of describing equations consists of eight ordinary differential equations which are solved numerically. For part 1 see N72-12226; for part 3, see N72-15264.
Author

N72-15174*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
HIGH SPEED DIRECT BINARY TO BINARY-CODED DECIMAL CONVERTER AND SCALER Patent Application
Pierce C. Toole, inventor (to NASA) Filed 16 Dec. 1970 28 p
(NASA-Case-KSC-10595; US-Patent-Appl-SN-98772) Avail: NTIS CSCL 09B

A high speed apparatus is described for scaling and converting binary numbers to binary coded decimal numbers which includes a plurality of decades connected in cascade. Programmed boards are provided for receiving binary numbers of predetermined weights and scaling the numbers up a predetermined multiple. Between each of the decades is a carry circuit, which supplies carry numbers to the succeeding decade and sends a corrector number back to a corrector circuit associated with the preceding decade. This corrector number is combined with binary numbers already stored in the corrector circuit to produce a proper signal on an associated readout device.
NASA

N72-15175*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ADVANCED ON-BOARD PROCESSOR (AOP)
Raymond G. Hartenstein, Charles E. Trevathan, and William N. Stewart Oct. 1971 28 p refs
(NASA-TM-X-65785; X-715-71-451) Avail: NTIS CSCL 09B

The goal of the Advanced On-Board Processor (AOP) development program is to design, build, and flight qualify a highly reliable, moderately priced, digital computer for application on a variety of spacecraft. Included in this development program is the preparation of a complete support software package which consists of an assembler, simulator, loader, system diagnostic, operational executive, and many useful subroutines. The AOP hardware/software system is an extension of the On-Board Processor (OBP) which was developed for general purpose use on earth orbiting spacecraft with its initial application being on-board the fourth Orbiting Astronomical Observatory (OAO-C). Although the OBP possesses the significant features that are required for space application, however, when operating at 100% duty cycle the OBP is too power-consuming for use on many smaller spacecraft. Computer volume will be minimized by implementing the processor and input/output portions of the machine with large scale integrated circuits. Power consumption will be reduced through the use of plated wire and, in some cases, semiconductor memory elements.
Author

N72-15176*# Philco-Ford Corp., Houston, Tex. Aerospace and Defense Systems Operations.
COMPUTER PROGRAM AND USER DOCUMENTATION MEDICAL DATA TAPE RETRIEVAL SYSTEM
J. Anderson 1 Nov. 1971 547 p
(Contract NAS9-11579)
(NASA-CR-115321; PHO-TN516) Avail: NTIS HC $6.00/MF $0.95 CSCL 09B

This volume provides several levels of documentation for the program module of the NASA medical directorate mini-computer storage and retrieval system. A biomedical information system overview describes some of the reasons for the development of the mini-computer storage and retrieval system. It briefly outlines all of the program modules which constitute the system.
Author

N72-15177*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RATE DATA ENCODER Patent Application
Wilford E. Sivertson, Jr., inventor (to NASA) Filed 26 Oct. 1970 12 p
(NASA-Case-LAR-10128-1; US-Patent-Appl-SN-84002) Avail: NTIS CSCL 09B

An apparatus and technique are described for encoding rate data. The expected range of the rate data is determined and the data falling within that range is encoded by conventional digital techniques. If the data falls either below or above the range, the encoding is stopped and signals are transmitted indicating that the data is not within the expected range.
NASA

N72-15178*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CHARACTER RECOGNITION SYSTEM Patent Application
Jung P. Hong, inventor (to NASA) Filed 18 Nov. 1970 14 p
(Contract NAS7-100)
(NASA-Case-NPO-11337; NASA-Case-NPO-11575; US-Patent-Appl-SN-90594) Avail: NTIS CSCL 09B

A character recognition system is described in which each character in a retina, defining a scanning raster, is scanned with random lines uniformly distributed over the retina. For each type of character to be recognized the system stores a probability density function (PDF) of the random line intersection lengths and/or a PDF of the random line number of intersections. As an unknown character is scanned, the random line intersection lengths and/or the random line number of intersections are accumulated and based on a comparison with the prestored PDFs a classification of the unknown character is performed.
NASA

N72-15179*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER PROGRAMS FOR PLOTTING CURVES WITH VARIOUS DASHED-LINE SEQUENCES
Robert N. Desmarais and Robert M. Bennett Washington Feb. 1972 68 p refs
(NASA-TM-X-2465; L-8064) Avail: NTIS CSCL 09B

Two FORTRAN-callable subprograms have been written to draw a smooth curve through a set of input points as a solid line or as a general sequence of long and short dashes. Subroutine LINSEQ draws conventional curves whereas subroutine CONSEQ draws smooth closed curves (contours). The subprograms are based on an approximate calculation of the arc length along the curve and spline interpolation along the arc length. Options are provided for smoothing of the input data and for offsetting the plotted curve from the input data points. The method of calculation of the arc length and the generation of the line sequence are described.Usage descriptions of the main subprograms, sample calling programs illustrating the various features of the subprograms, and sample plots are given. The subroutines should be readily adaptable to almost any computer-driven incremental plotter. Author

N72-15180# RAND Corp., Santa Monica, Calif.
LIMITS IN COMPUTING POWER
Willis H. Ware Oct. 1971 20 p refs Submitted for publication
(P-4710) Avail: NTIS

An overview is presented on the limitations of speed in which present day computers are capable of operating. Various types of problems are presented to illustrate how their size and complexity taxes the overall memory capacity of even the most modern computers available today. It is also shown that problems demanding solutions in the future will far exceed the capabilities of any existing computers. While this situation could be partially remedied by better mathematical approaches and more efficient program implementation, improved hardware capability is proposed as the only real answer. Based on this conclusion, an analysis is given of computer component speeds and the limitations imposed upon them by principles of physics, the logical arrangements used to implement arithmetic, and the overall internal machine architecture. D.L.G.

N72-15181# RAND Corp., Santa Monica, Calif.
BIOMOD: AN INTERACTIVE GRAPHICS SYSTEM FOR ANALYSIS THROUGH SIMULATION
G. F. Groner and R. L. Clark Oct. 1971 11 p refs Presented at the IEEE Decision and Control Conf., Miami Beach, Fla., 15-17 Dec. 1971
(Grant GM-15896)
(P-4707) Avail: NTIS

The characteristics of a computer system for aiding the design process are discussed. The features of such a system, whether based on mathematics or simulation, are described. The computer program provides a high degree of interaction, graphical displays, user-oriented system-description languages and flexible, in-depth system structuring. Author

N72-15182# Sandia Labs., Albuquerque, N.Mex.
INSTRUCTIONS FOR THE OPERATION OF THE PLAYBACK EXECUTIVE SYSTEM
W. C. Fienning Aug. 1971 9 p Sponsored by AEC
(SC-M-710477) Avail: NTIS

The Playback Executive System (PLEXS) is an interactive monitor for the Control Data Corporation model 3100 computer. The monitor provides for the following options for the operator: load and execute a requested program from the library tape; load and execute an object deck of assembled code from magnetic tape or cards; return control directly to PLEXS from any program; respond on the console typewriter to questions from programs; respond YES or NO to any inquiry; and dump portions of the computer memory as requested by the operator. Author (NSA)

N72-15183# Illinois Univ., Urbana. Dept. of Computer Science.
SYSTEM AND CIRCUIT DESIGN OF TRANSFORMATRIX COEFFICIENT PROCESSOR AND OUTPUT DATA CHANNEL Ph.D Thesis
Lawrence D. Ryan Jun. 1971 97 p refs
(Contract AT(11-1)-1469)
(COO-1469-176) Avail: NTIS

The special circuitry for the operations performed by the transformatrix to generate the appropriate coefficients are presented along with an analysis of an inexpensive D/A converter. Following multiplication of two sets of 1024 synchronous random pulse sequences, the products are summed by analog, and integrated to form the z-axis drive signal for each output light intensity. Transformatrix is described as a special purpose graphical processor which transforms an input picture represented by 32 x 32 light intensities into an output display of 32 x 32 light intensities in such a manner that each output intensities is equal to the weighted linear combination of the input intensities. F.O.S.

N72-15184# Tokyo Univ. (Japan). Inst. for Nuclear Study.
CAMP: COMPUTER AIDED MEASURING PROJECTOR FOR BUBBLE CHAMBER PHOTOGRAPHS
Taketora Yamagata Sep. 1970 14 p refs
(SJC-T-70-4) Avail: AEC Depository Libraries

The CAMP system comprises a film stage, Moire fringe digitizers, a desk-top screen, Rough Digitizers, a monitor TV, Dove prism control, automatic measuring devices, and a computer with peripheral units including a CRT display with a light pen. The film stage, driven by servomotors, is controlled manually or by the computer. Film images, magnified by ten times, are projected on the desk-top screen. The desk is provided with the Rough Digitizers (Bloch-type string digitizers), which are used by a human operator to indicate to the computer three points on a track to be measured. The computer calculates a circular path connecting these points, and drives the stage along the path (30mm/sec). As the stage is driven, the automatic measuring device (AMD) scans and measures track segments on the fly. The film area is scanned 100 times/sec within 2 mm from the optical axis. Calibrating light beam and a grating are used to calibrate the deflection angle of the rotating mirror. NSA

N72-15185# Douglas United Nuclear, Inc., Richland, Wash.
FAULT TREE SIMULATION COMPUTER PROGRAM
Paul A. Crosetti Jun. 1971 28 p refs
(Contract AT(45-1)-1857)
(DUN-7697) Avail: NTIS

Fault tree analysis provides a deductive functional development of a specific final undesired event through logic statements of the conditions which could cause the event. The usefulness of fault tree analysis is greatly enhanced through quantitative analysis or probability evaluation of the fault trees to provide a more objective basis for evaluating and improving the systems and to improve the precision of performance measurements and trade-off studies. Since a primary use for the fault tree method is to determine the more significant contributions to the probability of causing the undesired event, a feasible approach to probabilistic evaluation of the trees is to concentrate the effort on the dominant paths. This can be accomplished using Monte Carlo simulation, the simulation being performed on a computer using an event logic simulation program. The computer program discussed was prepared and used for quantitative evaluation of fault tree models as a tool for evaluating the functional performance of nuclear reactor protective systems in terms of system reliability and availability.
Author (NSA)

N72-15186# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Rechenanlagen.
DEVELOPMENT OF A TIME-SHARING SYSTEM FOR THE TELEPROCESSING OF WIND TUNNEL MEASUREMENTS WITH THE IBM 7040 COMPUTER AS CENTRAL

PROCESSOR
T. Herbert Nov. 1970 78 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-68; AVA-FB-7044; DK-681.14-523.8; DK-518.5) Avail: NTIS; ZLDI Munich: 20,50 DM

The IBM 7040 operating system, IBSYS, was originally designed for batched job processing. Following an analysis of the structure of tests and processing of data for the transonic and 3m-subsonic wind tunnel, a time-sharing system was developed on the basis of IBSYS. The new system provides background processing of batched jobs and foreground real-time analysis of measurement data, which is controlled from terminals in a dialog mode. In this mode of operation the results for each test point are listed and plotted on the terminal immediately following the measurement. Additional provisions are made for a limited remote job entry and for the use of the on-line plotters by batch jobs. Author (ESRO)

N72-15187# Oxford Univ. (England). Dept. for Engineering Science.
THE TRANSLATION OF SYMBOLIC ALGOL 1 TO SYMBOLIC ALGOL 2 BY THE STAGE2 MACRO-PROCESSOR
G. Kuo-Petravic, M. Petravic, and K. V. Roberts (UKAEA, Culham, Engl.) Nov. 1971 12 p refs Submitted for publication
(Rept-1004/71) Avail: NTIS

The facilities offered by the Stage2 macroprocessor are briefly described. The logic of the translator program written in Stage2 (TRANSTAG) is described fully, using the magnetic equation in the Trinity program as an example. The reduction to reverse Polish and the subsequent decoding back to a set of nested procedures in symbolic ALGOL 2 are explained. Author (ESRO)

N72-15188# Oxford Univ. (England). Dept. of Engineering Science.
AUTOMATIC OPTIMIZATION OF SYMBOLIC ALGOL PROGRAMS. PART 1: GENERAL PRINCIPLES
M. Petravic, G. Kuo-Petravic, and K. V. Roberts (UKAEA, Culham, Engl.) Jun. 1971 42 p refs
(Rept-1003/71) Avail: NTIS

Finite difference methods in several dimensions require in general that a relatively small number of equations be solved a large number of times. Much is gained if these nested procedure calls are executed only once. This is achieved by a generator or translator program, written in ALGOL, which processes input written in a related style named symbolic ALGOL 2. Usually only finite difference equations in very compact symbolic form are input, while output is completely explicit and can be in a number of computer languages. Of greatest interest are user or assembler codes automatically produced in this way. They are competitive in speed with fully hand-optimized FORTRAN versions and are produced effortlessly and error-free. Their speed, on the other hand, enables a full set of magnetohydrodynamic equations in three space dimensions to be solved in a reasonable time on a 60x60x60 or equivalent mesh, using an IBM 360/90 computer. Author (ESRO)

N72-15189# Oxford Univ. (England). Dept. of Engineering Science.
A USER'S GUIDE TO THE TRANSLATOR OF SYMBOLIC ALGOL 1 TO SYMBOLIC ALGOL 2 (TRANSTAG)
G. Kuo-Petravic, M. Petravic, and K. V. Roberts (UKAEA, Culham, Engl.) Apr. 1971 32 p
(Rept-1005/71) Avail: NTIS

The Stage 2 program TRANSTAG is reproduced together with explanations of the functions of all its sections. Modifications which the user may introduce in order to allow the program to accept equations in their mathematical form, as distinct from symbolic ALGOL 1, are also included. Author (ESRO)

N72-15190# Logos Development Corp., Middletown, N.Y.
OPTIMIZATION OF LOGOS 1 SYSTEM (PHASE 2) Final Technical Report, 1 Sep. 1970 - 31 Mar. 1971
Charles E. Byrne, James A. VanDerhaar, Bernard E. Scott, and Truong N. Binh Griffiss AFB, N. Y. RADC Jul. 1971 80 p
(Contract F30602-71-C-0063; Job Order 50650000)
(AD-728640; RADC-TR-71-142) Avail: NTIS CSCL 05/7

The report documents a research and development effort directed at optimization of the LOGOS I system for machine translation from technical English into Vietnamese. The following tasks were accomplished: expansion of the lexicographic data base of the system through addition of approximately 30,000 new terms in aeronautical, electronic, artillery and general technical areas; refinements in linguistic data base of the system, with a heavy emphasis on English resolution and Vietnamese transformation tables; experimentation with input processing techniques; development of an automated post-editing subsystem; development of a photocomposition subsystem for a large scale production of output in Vietnamese; pilot production of English-Vietnamese machine translation, including AFM-51-37, instrument flying, and JPA training manual for C123 K aircraft, and collection and analysis of cost/effectiveness data for all phases of machine translation production from input through final print. Author (GRA)

N72-15191# Naval Undersea Research and Development Center, San Diego, Calif.
ADAPTIVE SENSOR ARRAY PROCESSING Ph.D. Thesis
Burwell Brothers Goode Sep. 1971 220 p refs
(AD-731377; NUC-TP-259) Avail: NTIS CSCL 09/4

The paper brings together some recent research results in array signal processing. Several theories for optimum processing of directional signals in noise fields with known statistics lead to processor structures which are amenable to adaptive parameter adjustment. Several steepest descent adaptive algorithms can be used for multichannel detection and estimation. The paper analyzes the output signal-to-noise ratio of several power estimates using one of these algorithms. Assuming quasistationarity, the threshold directivity pattern is an efficient tool for evaluating the effects of slow changes in the signal and noise fields on the detection performance of any adaptive processor. Several examples illustrate the use of directivity patterns in the evaluation of array detection performance. Bounds on the excess mean-square error due to adaptation in a nonstationary environment show that the concept of quasi-stationarity does not imply strict stationarity. The complexity of the circuits implementing steepest descent adaptive algorithms can be reduced by averaging the gradient estimates, provided certain lower bounds on the number of bits in the quantized weights are used to avoid bias. This paper develops some analytical tools to assist the array processing engineer in deciding whether and how to design an adaptive array processor. Author (GRA)

N72-15192# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
AN INTERCONNECTION BETWEEN THE UNIVAC 1230 AND THE IBM 360/91 COMPUTERS FOR REAL-TIME RADAR STUDIES
A. Gerhart Witte Dec. 1970 33 p refs
(Contract N00017-62-C-0604)
(AD-730492; APL-TG-1345) Avail: NTIS CSCL 09/2

The Univac 1230 and the IBM 360/91 digital computers are connected by means of an asynchronous high-speed data link. The data link, developed by APL personnel, is capable of transferring 32-bit words at a maximum data rate of 167,000 words per second over a distance of 1000 feet. The main function of the data link is to provide an interconnection among the Univac 1230, the IBM 360/91, and a radar synchronizer in order to perform a real-time digital simulation of a radar environment. However, general-purpose data transfer may take place in a full duplex mode between the Univac 1230 and the IBM 360/91 computers without the need for the radar synchronizer. This report will give an overview of the hardware and software development of the high-speed data link. Author (GRA)

N72-15193# California Univ., Irvine. School of Engineering.
SYNTHESIS OF SUB-OPTIMAL FIXED LAG SMOOTHERS
J. S. Meditch Sep. 1971 9 p refs
(Grant AF-AFOSR-2116-71; AF Proj. 9749)
(AD-730603; AFOSR-71-2553TR) Avail: NTIS CSCL 09/4

The problem of suboptimal, fixed-lag smoothing for continuous-time stationary, random processes is examined. Two related synthesis procedures which are readily amenable to digital computation are developed and illustrated. Author (GRA)

N72-15194# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary Report, 1 May - 31 Jul. 1971
Melvin A. Herlin and Alan L. McWhorter 15 Aug. 1971 23 p
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-730600; ESD-TR-71-244) Avail: NTIS CSCL 09/2

The summary covers the period 1 May through 31 July 1971. It consolidates the reports of Division 2 (Data Systems) and Division 8(Solid State) on the Advanced Electronic Technology Program. Author (GRA)

N72-15856*# Wyle Labs., Inc., Huntsville, Ala.
ON-LINE COMPUTER APPLICATIONS FOR THE APOLLO SHORT STACK COMBINED ENVIRONMENTS TEST PROGRAM
Daniel J. Bozich *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 99-113 refs (See N72-15847 06-32)
(Purchase Order M8M3XAS-482000)
(NASA-CR-125414) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 09B

N72-15861 Ehrenpreis (David) Consulting Engineers, New York.
A CONVERSATIONAL TIME SHARING COMPUTER PROGRAM FOR DYNAMIC SHOCK ANALYSIS
Bruce A. Bott and Richard G. Gauthier (Gen. Dyn. Corp., Groton, Conn.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 153-164 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-15357# European Space Research and Technology Center, Noordwijk (Netherlands).
ONBOARD COMPUTERS FOR SATELLITES
Durney and Fokine *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 215-229 ref (See N72-15339 06-13)
Avail: NTIS

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N72-15195*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OMNIDIRECTIONAL MICROWAVE ANTENNA Patent Application
Thomas G. Campbell and Meredith W. Appleton, inventors (to NASA) Filed 18 Sep. 1970 9 p
(NASA-CASE-LAR-10163-1; US-Patent-Appl-SN-73310) Avail: NTIS CSCL 09E

An extremely thin microwave array antenna which is bonded circumferentially to the outside surface of a spacecraft and coated with a dielectric for thermal protection is reported. This antenna was designed for a specific payload application in the S-band (2200 to 2300 MHz) frequency range and provides an omnidirectional radiation pattern in the plane of the array and a near-omnidirectional pattern in the planes perpendicular to the array. NASA

N72-15196*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PARAMETRIC AMPLIFIERS WITH IDLER CIRCUIT FEEDBACK Patent Application
Hans-Juergen C. Blume, inventor (to NASA) Filed 17 Dec. 1970 12 p
(NASA-Case-LAR-10253-1; US-Patent-Appl-SN-99175) Avail: NTIS CSCL 09E

A method for connecting two parametric amplifiers in a manner to reduce the electronic noise is discussed. The amplifiers are connected in such a manner that there is feedback from the idler circuit of one amplifier to the idler circuit of the other amplifier. By reducing internally generated noise in parametric amplifiers it is possible to lower the overall noise level in radio receiving stations employing such amplifiers. P.N.F.

N72-15197*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTROSTATIC COLLECTOR FOR CHARGED PARTICLES Patent Application
Henry G. Kosmahl, inventor (to NASA) Filed 12 Nov. 1971 12 p
(NASA-Case-LEW-11192-1; US-Patent-Appl-SN-198285) Avail: NTIS CSCL 09E

A charged particle collector comprising a stack of apertured electrode plates which lie within an imaginary sphere is provided. The plate closest to a charged particle omitter forms a portion of the imaginary sphere and is at zero volts potential with respect to the omitter. The plate farthest away from the charged particle omitter is of conical shape with the apex pointing toward the omitter and includes a spike extending toward the omitter. A plurality of intermediate apertured electrode plates are positioned between the plate which forms a portion of the sphere and the conical plate, each of the plates being at a slightly lower potential than the proceding plate moving in a direction toward the omitter. These intermediate plates approximate the shape of an equipotential line which is plotted for the particular voltage applied to the plate. NASA

N72-15198*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOGICAL FUNCTION GENERATOR Patent Application
Wilford E. Sivertson, Jr., inventor (to NASA) Filed 16 Dec. 1970 20 p
(NASA-Case-XLA-05099; US-Patent-Appl-SN-98798) Avail: NTIS CSCL 09E

Standard logical elements are used in the construction of a special purpose computer for use in automatically designing logic circuits. The NAND logical element is used to illustrate the technique involved with this generator. The basic scheme provides for switching to permute a number of input literals and recursive inputs into a number of logical connective elements. The outputs from these connective elements provide the set of all functions possible from these connective elements and input literals. In addition, monitoring the switching states provides the set of all logical circuit connections associated with the set of all generated functions with a one-to-many mapping existing between functions and circuits. NASA

N72-15199*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LAMP MODULATOR Patent Application

John R. Zeman, inventor (to NASA) Filed 16 Dec. 1970 12 p
(NASA-Case-KSC-10565; US-Patent-Appl-SN-98517) Avail: NTIS CSCL 09E

An electronic apparatus for generating a visual indication of the presence and magnitude of a signal is described. The apparatus includes a transistor which amplifies an alternating electrical signal. A switching transistor is coupled to the output of the first transistor and is turned on by a portion of the positive half of the cycle of the signal. When the switching transistor is turned on it allows a capacitor to discharge through it for illuminating a lamp. The duration that the switching transistor turns on is directly proportional to the amplitude of the signal being monitored and, as a result, the intensity of the light produced by the lamp is directly proportional to the signal amplitude. NASA

N72-15200*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SELF-TUNING BANDPASS FILTER Patent Application
Gordon J. Deboo and Roger C. Hedlund, inventors (to NASA) Filed 13 Oct. 1970 17 p
(NASA-Case-ARC-10264-1; US-Patent-Appl-SN-80368) Avail: NTIS CSCL 09E

An electronic filter is described which simultaneously maintains a constant bandwidth and a constant center frequency gain as the input signal frequency varies. It remains self-tuning to that center frequency over a decade range. The filter utilizes a field effect transistor (FET) as a voltage variable resistance in the bandpass-frequency-determining circuit. The FET is responsive to a phase detector to achieve self-tuning. NASA

N72-15201# Australian Post Office Research Labs., Melbourne.
A NO-BREAK POWER SUPPLY: NPS-1
I. P. Macfarlane Oct. 1970 39 p refs
(CE-YR-5/5/1; Case-3078; Rept-6478) Avail: NTIS

Power supplies for equipment in a research installation have been constructed. Each supply is associated with a battery pack to enable continuous operation during periods of ac mains failure. Constant current charging facilities are provided, with automatic timing and termination of the charging period. Author

N72-15202# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
LOW CONVERSION LOSS DIODE RING MIXERS WITH FREQUENCY SELECTIVE TERMINATIONS
Rene J. Douville Jul. 1971 45 p refs
(CRC-1216) Avail: NTIS

The conversion loss of a diode ring terminated at its output by a narrowband tuned circuit and at its input by a wideband circuit is investigated. It is shown that the conversion loss of such a system can, in theory, be made arbitrarily small. A system operating at an input frequency range of 50 kHz to 300 kHz and an output frequency of 700 kHz is described and shown to exhibit less conversion loss than that of a resistively terminated diode ring mixer. A similar system designed to operate over an input frequency range of 1 MHz to 20 MHz is then described. It is shown that the performance of this system deviated from the theoretical and in fact, even without selective terminations, was able to achieve low conversion loss. Author

N72-15203# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
THE BAYESIAN RECEIVER FOR INTERFERING DIGITAL SIGNALS
R. R. Bowen Mar. 1971 29 p refs
(CRC-1215) Avail: NTIS

The Bayesian decision procedure is derived for the determination of the digits of an infinite m-ary digit sequence transmitted synchronously at a high rate over a known noisy dispersive linear communication channel. The procedure is optimum whenever a digit-by-digit modulation procedure is used and the significant intersymbol interference at the receiver input is between a finite number of digits. The case is considered in which the additive noise is white and Gaussian. The receiver that carries out the decision procedure is described. The receiver for binary pulse amplitude-modulated digits is described in detail, and its performance is compared with that of the linear equalizer and the decision feedback equalizer. Author

N72-15204*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PUSH-PULL TRANSISTOR AMPLIFIER Patent Application
William T. McLyman, inventor (to NASA) Filed 5 Oct. 1970 18 p
(Contract NAS7-100)
(NASA-Case-NPO-11365; US-Patent-Appl-SN-77785) Avail: NTIS CSCL 09E

An amplifier driven by a low power, square wave oscillator for obtaining an ac voltage from a dc source is improved by delaying turning on the nonconducting transistor until the conducting transistor is completely turned off. Thus any overlap in the conduction of the transistors due to the inherent slow turnoff operation of transistors is eliminated. The delay is provided by a separate reactor in the base drive circuit of each associated transistor. Each reactor is comprised of a core with a square loop hysteresis with two windings. NASA

N72-15205*# TRW Systems Group, Redondo Beach, Calif.
FAIL-SAFE MULTIPLE TRANSFORMER CIRCUIT CONFIGURATION Patent Application
Horacio Eduardo Gavira, inventor (to NASA) Filed 20 Oct. 1970 16 p Prepared for JPL
(Contracts NAS7-100; JPL-952151)
(NASA-Case-NPO-11078; US-Patent-Appl-SN-82280) Avail: NTIS CSCL 09E

A circuit configuration, useful in providing power to direct current loads is described. It includes a plurality of transformer circuits connected in parallel, each circuit including a diode bridge rectifier circuit, with the input terminals thereof connected across a secondary coil, and the output terminals mutually coupled in parallel with the output terminals of all other transformer circuits. Equalizing reactors are connected in series with the secondary coils to compensate for voltage imbalances that may develop in the transformer circuits. A direct current load may be connected across the mutually coupled output terminals of the respective transformer circuits. NASA

N72-15206*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FULL-WAVE MODULATOR-DEMODULATOR-AMPLIFIER APPARATUS Patent Application
James M. Black, inventor (to NASA) Filed 13 Jul. 1971 11 p
(NASA-Case-FRC-10072-1; US-Patent-Appl-SN-162100) Avail: NTIS CSCL 09E

A full wave modulator-demodulator apparatus including an operational amplifier having a first input terminal coupled to a circuit input terminal, and a second input terminal alternately coupled to the circuit input terminal and a circuit ground by a switching circuit responsive to a phase reference signal is described. The operational amplifier is alternately switched between a noninverting mode and an inverting mode. The switching circuit includes three field effect transistors operatively associated to provide the desired switching function in response to an alternating reference signal of the same frequency as an AC input signal applied to the circuit input terminal. NASA

N72-15207# Danish Research Centre for Applied Electronics, Copenhagen.
REED RELAYS: QUALITY EVALUATING INVESTIGATIONS OF SMALL REED RELAYS FOR MOUNTING IN PRINTED CIRCUITS. INVESTIGATIONS ENCOMPASS 20 FABRICATION TYPES
A. Bjerre Dec. 1971 48 p In DANISH; ENGLISH summary
(ECR-25) Avail: NTIS

Relays with a maximum contact load of about 10W were investigated. Contacts with either gold or rhodium coatings were included, along with a single mercury wetted type for comparison. Life tests of the relays during long time operation with various contact loads were of primary interest. A total of 400 relays performed 5 times 10 to the 8th power operations, each. Sensitivity toward humidity and mechanical influences were examined and measurements of operate, release and bounce times, operate and release voltages, and contact resistance were carried out. Results for each single test range are grouped together to facilitate evaluation of the advantages and disadvantages of a given relay. Author

N72-15208# Technische Hogeschool, Eindhoven (Netherlands).
OPTIMIZATION OF SMALL ac SERIES COMMUTATOR MOTORS Ph.D. Thesis
Reinder Hendrik Dijken 1971 190 p refs
Avail: NTIS

Because of the economic importance of the small series motor, an optimization method for this type motor has been developed. In this method, optimization means ensuring that the motor satisfies all the specifications with the minimum manufacturing costs. The characteristic properties of small commutator machines are described, along with five separate studies required for the optimization calculations. The computer program developed to calculate the required parameters is discussed in detail. A.L.

N72-15209# Sandia Labs., Albuquerque, N.Mex.
S-BAND DIPLEXER DEVELOPMENT
J. M. Stueber and D. L. Trapp Aug. 1971 69 p
(SC-DR-710299) Avail: NTIS

Electrical and physical design approaches, electrical test setups, and electrical and environmental test procedures employed in an S-band diplexer are described. The device is used in conjuction with S-band transmitters, on different frequencies within the telemetry portion of the S-band, for feeding a common antenna. Author (NSA)

N72-15210# Sandia Labs., Albuquerque, N.Mex.
PRECISION 295 MICROSECOND DELAY DEVICE
R. R. Weinmaster and R. D. Blackshire 1971 10 p Presented at the 7th Symp on Explosives and Pyrotechnics, Philadelphia, 9 Sep. 1971 Sponsored by AEC Prepared in cooperation with Unidynamics/Phoenix, Ariz.
(SC-DC-713816; Conf-710906-1) Avail: NTIS

A delay device was required which would attain a high voltage electrical switch closure at 295 + or -5 microsec after the input of an EBW firing pulse. A device was designed, built, and tested which utilizes an EBW detonator, an MDF delay element, and an explosively activated solid dielectric switch. A timing accuracy of 295 + or -2 microsec was achieved over the extreme temperature range. All detonator products were contained. Author

N72-15211# Bendix Corp., Kansas City, Mo.
ELECTRICAL TERMINATIONS: WELDED, BRAZED, AND BONDED Quarterly Report
D. E. Stittsworth Jul. 1971 67 p
(Contract AT(29-1)-613)
(BDX-613-427; FY-71-3) Avail: NTIS

Development of in-process monitoring equipment and brazeable flexible circuit terminations was begun. In-process monitoring capability is being developed for use on opposed-electrode, parallel-gap, percussive-arc, and pulse-arc welding processes. Flexible-circuit test coupons were fabricated for development of production welding processes to be used in terminating flexible circuits to component pins or to other flexible circuits. The equipment and processes developed during this reporting period have not been fully evaluated, but indicate potential for attainment of the project objectives. Author

N72-15212# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Sukumi (USSR). Fiziko-Tekhnicheskii Inst.
MULTITUBE GENERATING BANK
G. I. Zverev, V. L. Lyulev, V. B. Mayburov, I. S. Savchenko, and I. R. Yampolskii 1970 14 p refs In RUSSIAN
(NP-18943; Preprint-6) Avail: AEC Depository Libraries

Four-phase vacuum tube oscillators for exciting circuits forming high frequency fields of various configurations for plasma physics research are described. The oscillators can operate in two modes: independent excitation and self exciting oscillation. In the self exciting oscillation mode, the field forming circuit is the load. The total installed power of the generating bank tubes is more than 80 MW in a 1 to 1.5-msec pulse with a duty cycle of 0.5 to 2 mHz and a pulse repetition rate of 0.05 to 0.1 Hz. The problem of obtaining high power is solved by summing the summing the powers of the groups of oscillator tubes included in paralled in the load. NSA

N72-15213# Ingenieurburo G. Hopp, Munich (West Germany).
PULSED NUCLEAR RADIATION EFFECTS ON ELECTRONICS IN TANKS [EINWIRKUNG GEPULSTER KERNSTRAHLUNG AUF BAUGRUPPEN IN KAMPFPANZERN]
H. Bruemmer, R. Ortmann, H. Reker, and W. Renz Bonn Bundeswehramt 1971 153 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-71-17) Avail: NTIS; Bundeswehramt: 25 DM

The interactions of nuclear radiation with semiconductor materials and its effects on electronic devices and electronics in general are described in detail. The most important semiconductor devices and their behavior under irradiation are discussed. The nuclear environment has been treated, the methods of experimental and analytical simulation of the behavior of electronics in a nuclear environment are documented, and the necessity of radiation hardening is shown. Author (ESRO)

N72-15214# Royal Aircraft Establishment, Farnborough (England).
A VERSATILE LIGHTWEIGHT DATA SYSTEM SUITABLE FOR PHYSIOLOGICAL RESEARCH
W. H. Hole and V. Lavelle Jan. 1971 42 p refs
(RAE-TR-71005) Avail: NTIS

A flexible system for data recording and acquisition is described based on consumer equipment. It was found suitable for magnetic tape recording of two data channels or for their transmission and reception over a radio link for remote handling. The portable system and radio transmitter are of small dimensions. Special playback filters and discriminators were developed. Apparatus for the retrieval of data is described. ESRO

N72-15215# Royal Aircraft Establishment, Farnborough (England).
THE DETECTION OF EXCITATION FAULTS IN PARALLELED ALTERNATORS BY A COMPARATIVE METHOD
R. F. Sims and R. L. A. McKenzie Nov. 1970 16 p refs
(RAE-TR-70196) Avail: NTIS

Circuits developed for application in the protection of paralleled alternators against voltage regulator of excitation faults are described. The faults are detected by comparing the regulator output with that of a second monitor amplifier, which is in effect a scaled down version of the main regulator amplifier. The amplifiers selected for this purpose incorporate high gain operational amplifiers with sufficient negative feedback to give linear characteristics which can be adjusted to be practically identical. Integrated microcircuits are used whenever possible for the sake of reliability and stability. ESRO

N72-15216# Royal Aircraft Establishment, Farnborough (England).
A DUAL OUTPUT 1.6 GHz SOLID-STATE POWER SOURCE
B. Lake Jan. 1970 18 p refs
(RAE-TR-70002; UDC-621.374.4) Avail: NTIS

An experimental system feeding two antennas with 10 W

at 1.6 GHz is described, with possible application to aircraft communication via a satellite. This was achieved by frequency multiplication and power amplification of an existing 400 MHz power source. Two frequency doubling stages were used in each arm of the system, after division with a coaxial hybrid tee junction. A UHF power transistor was used in the varactor mode to produce power gain in addition to frequency doubling, and this was followed by a step recovery varactor diode frequency doubler producing 10W at 1.6 GHz. ESRO

N72-15217# Signals Research and Development Establishment, Christchurch (England).
A VOLTAGE CONTROLLED DELAY GENERATOR
K. G. Roots Oct. 1970 14 p
(SRDE-70044; BR-25649) Avail: NTIS

A voltage controlled delay generator is described which permits sampling techniques to be used to give improvements in signal to noise ratio of experimental, repetitive waveforms, such as in fluorescence decay analysis. The use of a slowly rising linear ramp voltage to provide a continuously variable delay of a pulse relative to a clock pulse provided a significant increase in the accuracy of sampling over a previous scheme which relied upon a mechanical method to control the variable delay potentiometer of a pulse generator. A voltage versus time ramp in excess of one hour was possible by using pulses to control the charging rate of a capacitor connected in an insulated gate field effect transistor circuit. ESRO

N72-15218# Technische Hochschule Munchen (West Germany). Inst. fuer Technische Elektronik.
THE NOISE OF IMPATT DIODE AMPLIFIERS AND OSCILLATORS
Gerhard Ulrich Bad Godesberg, West Ger. Bundesmin. Fuer Bildung und Wiss. May 1971 117 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-71-24; DK-621.382.33; DK-621.391.822) Avail: NTIS; ZLDI Munich: 24,15 DM

The noise of an avalanche diode amplifiers is investigated experimentally and compared to small signal noise theories. A quasistationary calculation for the spectra of the amplitude and frequency fluctuations, is given for the oscillator in the free running and the phase locked mode. Both the real and the imaginary parts of the amplitude dependence of the diode impedance and of the frequency dependence of the load impedance are included. Conditions for minima of AM- and FM-noise are indicated and confirmed by experiments at X-band frequencies. The reduction of AM- and FM-noise of the phase locked oscillator is demonstrated. Author (ESRO)

N72-15219# SACLANT ASW Research Center, la Spezia (Italy).
A DESCRIPTION OF SOME RECURSIVE DIGITAL FILTERS
Jens M. Hovem and Martin Thompson 15 Jun. 1971 26 p refs
(AD-728979; SACLANTCEN-TM-167) Avail: NTIS CSCL 09/5

A set of digital recursive filters has been programmed on a digital computer. The filters are low-pass and band-pass realization of Butterworth and Bessel characteristics. The method of synthesis, which is described, is by means of the matched Z-transform of corresponding analogue filters. Some examples of time and frequency responses of the filters are presented. Author (GRA)

N72-15220# Bendix Corp., Sidney, N.Y. Electrical Components Div.
RELIABLE INTEGRATED WIRE TERMINATION DEVICES Semiannual Report, Jan. - Jun. 1971
Donald L. Pfendler and Donald H. Gould Oct. 1971 44 p
(Contract DAAB07-71-C-0090)
(AD-731295; ECOM-0090-1; SAR-1) Avail: NTIS CSCL 09/1

The purpose of the investigation is to cover the design and evaluation of a wire termination system capable of interconnection to a variety of multi-contact connectors such as cylindrical, rectangular rack and panel, printed circuit board, and terminal junction devices. The connective devices are to be capable of assembly and maintenance with a common tool for terminal insertion and withdrawal. In addition, the various connective devices shall be capable of reliably withstanding the environmental conditions encountered by both ground and airborne army equipment. Primary emphasis will be directed toward a significant improvement of the reliability and maintainability of wiring systems in army aircraft. A number of design layouts were made to illustrate some basic ideas for retaining a terminal in a wiring device. A review of these layouts has concluded in a choice of a type of dielectric and a type of metallic terminal retention that will be fabricated. A study of the style of the terminal (male or female) has concluded that a female terminal is the best choice. Prototype test samples are being fabricated (both metallic and dielectric retention) and will be evaluated according to the prepared test procedure. Terminal insertion and removal tools are being purchased and will be evaluated according to a test procedure that will be prepared. Author (GRA)

N72-15221# Michigan Univ., Ann Arbor. Electron Physics Lab.
MICROWAVE SOLID-STATE DEVICE AND CIRCUIT STUDIES Quarterly Progress Report, 1 Mar. - 1 Jun. 1971
G. I. Haddad, W. R. Curtice, R. J. Lomax, N. A. Masnari, and J. E. Rowe Aug. 1971 104 p refs
(Contract F30602-71-C-0099; Job Order 55730000; Task-557303)
(AD-730636; Rept-037250-3; RADC-TR-71-170) Avail: NTIS CSCL 09/1

Objectives are to investigate theoretically and experimentally new solid-state phenomena and techniques having application to microwave generation, amplification and control. Current tasks under the program are: High-power Gunn-effect devices; Gunn-effect amplifiers; Modulation properties of Gunn-effect devices; Avalanche-diode amplifiers; High-efficiency avalanche diodes; Nonlinear operating characteristics of IMPATT diodes; Solid-state device fabrication; Instabilities in germanium. Author (GRA)

N72-15222# Stanford Univ., Calif. Information Systems Lab.
MINIMIZATION OF ROUNDOFF NOISE IN DIGITAL FILTERS
William Ng Lee Aug. 1971 117 p refs Sponsored in part by GTE Lenkurt, Inc.
(Contract N00014-67-A-0112-0044)
(AD-730505; SU-SEL-70-076; SU-TR-6560-23) Avail: NTIS CSCL 09/5

One limitation of the digital filter is the error caused by the rounding of the data to fit in the prescribed word length. Another important constraint is on the dynamic range of the filter which is set by the finite-purpose computer, fixed-point arithmetic is usually preferred to floating point because it leads to simpler construction. Representation as additive white noise is made of the roundoff error resulting from fixed-point arithmetic operations under the assumption of independence of the error sequence from sample to sample and from source to source. Synthesis procedures are described based on the minimax noise principle for the minimization of the roundoff noise within the limitations imposed by the dynamic range constraints. The minimax noise principle developed in the thesis asserts that the roundoff noise is minimized if the states of the filter are chosen such that they are well-behaved. Applications of the principle have led to digital filter structures modeled on classical lumped inductor-capacitor networks in both ladder and lattice forms. The most important application lies in its incorporation into the cascade canonical realization of the filter. Computer predictions of the roundoff noise of sample filters serve to verify the principle. The cascade structure designed according to the minimax principle is shown to possess noise characteristics superior to those arising from other known cascade design methods. Author (GRA)

N72-15223# GTE Sylvania, Inc., Mountain View, Calif. Electro-Optics Organization.
TEN MICRON WIDEBAND DETECTOR Final Report, 1 Apr. - 30 Jul. 1971
J. Falk and J. M. Yarborough 30 Sep. 1971 79 p refs
(Contract N00014-70-C-0224; ARPA Order 306)
(AD-730493) Avail: NTIS CSCL 09/5

The report summarizes the results obtained during a sixteen month parametric upconversion program. The goal of the program was the visualization of a thermal image via parametric upconversion. Toward that end a theoretical and experimental effort was undertaken. The theory of parametric upconversion was extended to describe the detection of a thermal image by frequency conversion. The theory developed describes the power output, resolution, contrast and spectral bandwidth to be expected from a thermal upconverter. Author (GRA)

N72-15224# Rensselaer Research Corp., Troy, N.Y. Electronic Systems Dept.
BULK SEMICONDUCTOR LIMITERS Final Report, 1 May 1970 - 30 Apr. 1971
Albert L. Armstrong, Paul E. Bakeman, Jr., Wayne C. Taft, and John N. Park Oct. 1971 121 p refs
(Contract DAAB07-70-C-0195; Task-1H6-62705-A-056-04)
(AD-731498; ECOM-0195-F) Avail: NTIS CSCL 09/1

Theoretical and experimental efforts have been continued toward the realization of bulk semiconductor limiter components. Significant progress has been achieved in the areas of thermal analysis, isolation characteristics, recovery characteristics, noise evaluation, encapsulation and cascade operation. A theoretical analysis has been developed which yields the temperature profile of the limiter structure as a function of space and time. Refinements in fabricating checkerboard contact limiter elements, which were invented during the previous contract period, were made which produced superior limiting characteristics, lower spike leakage, and faster device recovery. Microwave recovery period noise was measured on phosphorus diffused silicon limiter elements. Both a double slit gas encapsulated Ku-band limiter component and a single slit X-band plastic encapsulated unit were fabricated and tested successfully to 10 kilowatts without external pressurization. Cascade bulk semiconductor limiter structures were tested at X-band with input transmitted powers from 5 watts to 10 kilowatts. Author (GRA)

N72-15848 Arizona State Univ., Tempe.
THE RESPONSE OF TRANSDUCERS TO THEIR ENVIRONMENT: THE PROBLEM OF SIGNAL AND NOISE
Peter K. Stein *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 1-16 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-15858 New Mexico Univ., Albuquerque. Dept. of Mechanical Engineering.
A DYNAMIC DATA COMPENSATION TECHNIQUE FOR SEISMIC TRANSDUCERS
G. L. Schulz and W. E. Baker *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 123-132 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-15801# Technische Hogeschool, Delft (Netherlands).
DETERMINISTIC VERSUS STOCHASTIC SIGNALS
R. G. Boiten *In* Soc. of Environ. Engr. Environ. Eng. 1970 59 p (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N72-15225 E-A Space and Advanced Military Systems, Ltd., Camberley (England).
ANALYSIS OF LARGE NETWORKS
1 Feb. 1971 41 p
(Appl-Note-2-Ser-1) Copyright. Avail: Issuing Activity

Techniques for organizing networks of information for computer processing are described. Two basic methods, high level activities and key events, are involved in the process. The limitations imposed on the network by the program and the facilities available for data processing are discussed. Examples of data summarization prior to computer processing are presented.
Author

N72-15226# Toulouse Univ. (France).
CONTRIBUTION OF FAULT DETECTION IN LOGIC CIRCUITS Ph.D. Thesis [CONTRIBUTION A LA DETECTION DES PANNES DANS LES CIRCUITS LOGIQUES]
Jean-Pierre Richard 1971 191 p refs In FRENCH
Avail: NTIS

The utilization of algorithms, Boolean and topology methods to diagnose electrical faults in circuits is discussed. The circuits examined include logic, combinational, and sequential. E.H.W.

N72-15227# Energiya Publishing House, Leningrad (USSR).
SENSITIVITY OF AUTOMATIC CONTROL SYSTEMS
Ye. N. Rozenvasser and R. M. Yusupov 1969 207 p refs In RUSSIAN
(UDC-62-503.4) Avail: NTIS

A systematic discussion is presented concerning the application of sensitivity theory to automatic control systems, especially in relation to technical cybernetics. Small perturbation theory is of particular significance in this connection. Fluctuations in structural parameters and optimal criteria are considered.
Transl. by K.P.D.

N72-15228*# Radiation, Inc., Melbourne, Fla. Radiation Systems Div.
HANDBOOK: DESIGN OF AUTOMATED REDUNDANCY VERIFICATION
F. A. Ford, T. W. Hasslinger, and F. J. Moreno Jul. 1971 209 p
(Contract NAS10-7420)
(NASA-CR-125311; Rept-7620-71-001) Avail: NTIS CSCL 09C

The use of the handbook is discussed and the design progress is reviewed. A description of the problem is presented, and examples are given to illustrate the necessity for redundancy verification, along with the types of situations to which it is typically applied. Reusable space vehicles, such as the space shuttle, are recognized as being significant in the development of the automated redundancy verification problem. Author

N72-15229*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
POWER PROCESSING
Francisc C. Schwarz Washington 1971 53 p refs
(NASA-SP-244; LC-71-609944) Avail: NTIS; SOD $0.35 CSCL 09C

Processing of electric power has been presented as a discipline that draws on almost every field of electrical engineering, including system and control theory, communications theory, electronic network design, and power component technology.

The cost of power processing equipment, which often equals that of expensive, sophisticated, and unconventional sources of electrical energy, such as solar batteries, is a significant consideration in the choice of electric power systems. Author

N72-15230*# Mississippi State Univ., State College. Dept. of Electrical Engineering.
TRENDS IN SOLID STATE ELECTRONICS, PART 2 Interim Report
J. D. Gassaway 12 Jan. 1972 120 p refs
(Contract NAS8-26749)
(NASA-CR-123494) Avail: NTIS CSCL 09C

Developments in the fields of semiconductors and magnetics are surveyed. Materials, devices, theory, and fabrication technology are discussed. Important events up until the present time are reported, and events are interpreted through historical perspective. A brief analysis of forces which have driven the development of today's electronic technology and some projections of present trends are given. More detailed discussions are presented for four areas of contemporary interest: amorphous semiconductors, bubble domain devices, charge-coupled devices, and electron and ion beam techniques. Beam addressed magnetic memories are reviewed to a lesser extent. Author

N72-15231# Bendix Corp., Kansas City, Mo.
REFERENCE ELECTRODE AND ITS USE IN DETERMINING INDIVIDUAL ELECTRODE POTENTIALS
P. E. Klingsporn Jul. 1971 31 p refs
(Contract AT(29-1)-613)
(BDX-613-412) Avail: NTIS

A saturated calomel reference electrode (SCRE) was used to measure the potential of gold and copper electrodes immersed in KAu(CN)2 and CuDTPA baths respectively, in the absence of a net current. The measurements were made at the gold and copper concentrations present in the gold-copper bath used to electroplate 95 percent by weight gold-5 percent by weight copper alloy. Changing the copper concentration in the CuDTPA bath by a factor of 2.0 changed the copper electrode potential versus the SCRE in a manner such that the ratio of the copper ion activities (as calculated from the Nernst equation) was 1.86 which is nearly the same as the concentration ratio. In contrast, changing the gold concentration by a factor of 2.0 altered the gold electrode potential such that the calculated gold ion activity ratio had the unusually high value of 15.5. The potential of a rotating gold cathode sustaining a net current was measured relative to the SCRE in the presence of forced convective diffusion. At a constant cell voltage of 1.0 volt, a change in rotation rate by a factor of 5.5 changed the cathode potential by 0.04 volt. Author

N72-15232# Royal Aircraft Establishment, Farnborough (England).
AN APPLICATION OF COMPUTER TECHNIQUES TO THE ANALYSIS AND DESIGN OF SMALL SIGNAL LINEAR CIRCUITS
M. J. Martin May 1970 76 p refs
(RAE-TR-70086; BR-21487) Avail: NTIS

Applications of computer programming to linear network design and analysis are described. Design of a small signal linear amplifier is given as an example. Direct and alternating current analyses are presented. Author (ESRO)

N72-15233# Applied Science Associates, Inc., Valencia, Pa.
GUIDANCE AND SPECIFICATIONS FOR THE PREPARATION OF FULLY PROCEDURALIZED JOB AIDS FOR ORGANIZATIONAL AND INTERMEDIATE MAINTENANCE OF ELECTRONIC SUBSYSTEMS Final Report, Apr. 1970 - Jan. 1971
Andrew P. Chenzoff, William J. Mallory, and Reid P. Joyce Brook, AFB, Tex. AF Human Resources Lab. Jun. 1971 128 p refs
(Contract F33615-70-C-1500; AFHRL Proj. 1710; ASD Proj. 1559)
(AD-731144; ASA-150-70-1500-1; AFHRL-TR-71-23) Avail: NTIS CSCL 09/3

The report supplies a model for specifications for the preparation of fully proceduralized job aids for organizational and intermediate maintenance of electronic subsystems, and offers guidance in the preparation of such aids. The aids to be developed from these specifications are for flight-line or field-shop maintenance of any electronic subsystem, and support the performance of the following maintenance functions as needed: checkout, alignment, repair, adjustment, calibration, malfunction localization, malfunction isolation, and the removal and replacement of malfunctioning equipment items.
Author (GRA)

N72-15234# Naval Air Development Center, Johnsville, Pa.
PROCEEDINGS OF SYMPOSIUM ON ADVANCED AIRCRAFT ELECTRIC SYSTEMS (SOSTEL)
22 Apr. 1971 212 p refs Symp held at Warminster, Pa., 20-22 Apr. 1971
(AD-731077) Avail: NTIS CSCL 09/3

Contents: SOSTEL II data handling system; The logical approach to power management; Application of solid state power management; SOSTEL for A-7 electrical system; An automatic electrical distribution system; Application study results for multiplexed aircraft electric systems; Plated wire memories for military application; A cost effective solid state indication and control; Solid state power controllers; Solid state power controllers, circuit breakers, and relays for present day aircraft; Compatibility of solid state power controllers with aircraft electric systems; Remote power switch with overcurrent protection; A new miniature state-of-the-art proximity switch for position sensing; Transcalent semiconductor development; High voltage DC power systems for aircraft. GRA

N72-15235# Office of Naval Research, London (England).
THE 5TH INTERNATIONAL CONFERENCE ON MAGNETO-HYDRODYNAMIC ELECTRICAL POWER GENERATION
Alfredo Banos, Jr. 16 Jul. 1971 26 p refs Conf. held at Munich, 19-23 Apr. 1971
(AD-730450; ORNL-C-15-71) Avail: NTIS CSCL 10/2

The report gives an account of the last three sessions which included round table discussions by panels of experts. In addition, the Appendix gives a complete list of the papers presented. Author (GRA)

N72-15236# Maryland Univ., College Park. Dept. of Electrical Engineering.
MULTIPLE dc SOLUTION ONE TRANSISTOR CIRCUITS
A. Baranyi and R. Newcomb Oct. 1971 10 p refs
(Grants AF-AFOSR-1910-70; NSF GK-24036; AF Proj. 9749)
(AD-731117; AFOSR-71-2648TR) Avail: NTIS CSCL 09/5

The necessary and sufficient conditions are given for the existence of multiple DC solutions of circuits consisting of one ideal Ebers-Moll transistor embedded in an admittance described circuit consisting of batteries and linear passive resistors and ideal transformers. The results rest upon the previous theories of Sandberg and Willson. Author (GRA)

N72-15237# Air Force Cambridge Research Labs., Bedford, Mass.
IMPEDANCE CIRCUITS IMBEDDING AN LC-LATTICE TWO-PORT Physical Sciences Research Papers
Kurt H. Haase 21 May 1971 102 p refs
(AF Proj. 5628)
(AD-731176; AFCRL-71-0303; AFCRL-PSRP-455) Avail: NTIS CSCL 09/5

A novel procedure for realizing certain driving-point impedances without the use of transformers is discussed. The circuits obtained imply an LC-lattice two-port, and they are smaller, lighter, and have considerably fewer elements than do conventional (Bott-Duffin) circuits. Author (GRA)

N72-15238# Princeton Univ., N.J. Dept. of Electric Engineering.
A STUDY OF NETWORK AND SYSTEM SENSITIVITY OF SIGNAL PROCESSORS FOR USE IN AIR FORCE SYSTEMS SUCH AS COMMAND AND CONTROL SYSTEMS Final Scientific Report, 1 Jul. 1967 - 31 Aug. 1971
M. E. VanValkenburg 27 Sep. 1971 12 p refs
(Grant AF-AFOSR-1333-67)
(AD-731294; AFOSR-71-2655TR) Avail: NTIS CSCL 09/4

Contents: Systems with unknown, uncertain, or varying parameters; Effect of finite word length on accuracy of digital signal processors; Computer generated holograms and spatial filters; Random signal and systems. GRA

N72-15825*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRANSIENT WAVEFORM CONTROL OF ELECTROMAGNETIC TEST EQUIPMENT
John D. Favour (Boeing Co., Seattle), Jay M. LeBrun (Boeing Co., Seattle), and Joseph P. Young *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 157-171 refs (See N72-15812 06-32)
(Contract NAS5-15171)
(NASA-TM-X-67588) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 09C

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N72-15239# Communications Research Centre, Ottawa (Ontario).
TEST MEASUREMENTS ON A 13 FT BY 9.8 FT BY 7.5 FT MICROWAVE ANECHOIC CHAMBER
B. Clarke and R. Breithaupt Aug. 1971 17 p refs
(CRC-TN-633) Avail: NTIS

Antenna measurement errors made in a rectangular 13 ft x 9.8 ft x 7.5 ft anechoic chamber due to net reflections from all walls, ceiling and floor were measured at frequencies of 1.0, 1.8, 4.0, 12.4 and 18 GHz. These results are presented, and the effect of test antenna beamwidths and chamber shape modifications is discussed. Author

N72-15240*# Alabama Univ., University. Coll. of Engineering.
A STUDY AND ANALYSIS OF THE MSFC LUNAR ROVING VEHICLE DUST PROFILE TEST PROGRAM Final Report, 11 Dec. 1970 - 30 Jul. 1971
C. Howell Mullis Nov. 1971 32 p
(Contract NAS8-26715)
(NASA-CR-121075; BER-139-92) Avail: NTIS CSCL 13F

The dust problem and fender design for the LRV were studied under reduced gravity with a lunar soil simulant. The test equipment, soil characteristics of the lunar soil simulant, and the test procedures are described. It is concluded: (1) The fender plus flap design is adequate. (2) Vacuum conditions tend to eliminate or reduce suspended dust clouds. (3) Reduced gravity conditions tend to increase the dust problems. (4) Slow starting speeds are necessary to minimize slip and reduce initial dust generation. F.O.S.

N72-15241*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIFT BALANCING DEVICE Patent Application
Perry W. Hansen, inventor (to NASA) Filed 8 Sep. 1970 8 p
(NASA-Case-LAR-10348-1; US-Patent-Appl-SN-70032) Avail: NTIS CSCL 14B

A static force balancing system is described which is attached to a lifting body flying on a free flight suspension system in a wind tunnel. The system balances the static lift forces generated in excess of lifting body weight, while permitting freedom of movement of the lifting body in response to dynamic forces. The static forces are balanced by the flow of pressurized air against a piston sliding loosely in a casing. Friction between piston and casing is eliminated by a portion of the pressurized air leaking past the piston. Force variation with piston position is eliminated by providing a pressure reservoir connected to the casing which acts as an accumulator. NASA

N72-15242# National Aerospace Lab., Amsterdam (Netherlands).
HOT JET SIMULATION FACILITY FOR NLR WIND TUNNELS
[1971] 10 p
Avail: NTIS

A comprehensive description is given of an operational system for simulating hot jets of aircraft and rocket models in its low speed, transonic and supersonic wind tunnels. Stagnation jet temperatures can be reached, ranging from 250 C to 980 C, while the maximum attainable stagnation jet pressure is 60 kilograms per square centimeter. Author

N72-15243# National Aerospace Lab., Amsterdam (Netherlands).
VADEMECUM ON FACILITIES AND ADDITIONAL EQUIPMENT
[1971] 41 p refs
Avail: NTIS

Technical information is presented on the research facilities and equipment available at the National Aerospace Laboratory in Amsterdam. These include a modern workshop and an electronics department for the manufacture of wind tunnel models, instruments, and instrumentation systems. Equipment specifications for fluid dynamic and structural test equipment are given. Author

N72-15244*# Education Research, Inc., Berkeley, Calif. 01e
ECONOMIC UTILIZATION OF GENERAL AVIATION AIRPORT RUNWAYS
Robert R. Piper Apr. 1971 235 p refs
(Contract NAS2-5737)
(NASA-CR-114406) Avail: NTIS

The urban general aviation airport economics is studied in detail. The demand for airport services is discussed, and the different types of users are identified. The direct cost characteristics of the airport are summarized; costs to the airport owner are largely fixed, and, except at certain large airports, weight is not a significant factor in airport costs. The efficient use of an existing airport facility is explored, with the focus on the social cost of runway congestion as traffic density at the airport builds up and queues form. The tradeoff between aircraft operating costs and airport costs is analyzed in terms of runway length. The transition from theory to practice is treated, and the policy of charging prices only on aircraft storage and fuel is felt likely to continue. Implications of the study from the standpoint of public policy include pricing that spreads traffic peaks to improve runway utilization, and pricing that discriminates against aircraft requiring long runways and causes owners to adopt V/STOL equipment. Author

N72-15245# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
FEASIBILITY TESTS OF A COMMERICIAL RADIOGRAPHIC LINAC FOR NUCLEAR MATERIALS ASSAY
E. Wattacamps (Ges. fuer Kernforschung), L. A. Kull (Brookhaven Natl. Lab.), G. M. Reynolds, and E. Neinstock 1970 28 p refs Presented at 12th Ann. Meeting of the Nuc. Mater. Management, West Palm Beach, Fla., 29 Jun. 1971 Sponsored by Brookhaven

Natl. Lab.
(Conf-710617-13) Avail: NTIS

Tests were made on a variable energy, standing-wave radiographic electron linac to determine the feasibility of using commercially available electron linacs for nondestructive assays of special nuclear materials. Assay techniques similar to those developed in safeguards research were used to test the linac parameters that are important for nondestructive measurements. The following test results were obtained. The neutron yield/dose for a nuclear materials assay system employing a side coupled standing wave linac without a magnetic analysis system, is stable to within 2% at the lower end of the range of useful assay energies and to within 1% at the upper end. Assays separated by beam-off periods and by electron energy changes are reproducible to within 2%, for the lower (upper) end of this same energy range. Author (NSA)

N72-15246# California Univ., Livermore. Lawrence Radiation Lab.
RESPIRATOR CARTRIDGE EFFICIENCY STUDIES. 3: DEVELOPMENT OF A MECHANICAL BREATHING MACHINE TO SIMULATE HUMAN RESPIRATION
Robert E. Johnson, Carl L. Lindeken, and Robert D. Taylor 21 Jun. 1971 13 p refs
(Contract W-7405-eng-48)
(UCRL-51072) Avail: NTIS

A mechanical breathing machine has been developed to simulate the human breathing cycle. This machine has a variable speed and torque control that can simulate five human breathing patterns: sedentary, 208, 415, 622, and 830 kg-m/ min These patterns are produced by the stroke action of twin pistons controlled by replaceable cams, each machined for one of the five work rates. Values obtained for amplitude, period, and minute volume correspond closely to those outlined in the Respiratory Protective Devices Manual. Author

N72-15247# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Leningrad (USSR).
SELECTION OF AN OPTIMAL COOLING SYSTEM FOR SUPERCONDUCTING MAGNETS
L. B. Dinaburg and V. V. Kalinin 1970 18 p refs In RUSSIAN; ENGLISH summary
(NP-18978; Preprint-B-0109) Avail: AEC Depository Libraries

Problems of the selection of cooling systems for superconducting magnets that are optimal from the viewpoint of power consumed for compensation of heat inflow to liquid helium are discussed. Estimated data are given on the amount of consumed power by liquefied, refrigerative, and intermediate (combined) cycles of a mean-pressure cooling installation. Based on thermal characteristics of currently used thermal insulating materials and data on consumed power for the cooling cycles, calculations are made for manufacture of various cooling systems: (1) a cryogenic installation and (2) a cryostat with a wide range of values of heat inflows along thermal insulating barriers and thermal bridges. A comparative analysis of data obtained is given. Author (NSA)

N72-15248# Laboratoire d'Aerothermique du C.N.R.S., Bellevue (France).
GROUND STATION FOR FROST OBSERVATIONS AT CAEN: PRESENTATION OF THE FIRST EXPERIMENT
A. Philippe, J. Aguirre-Puente, and H. Bertouille Sep. 1970 70 p refs In FRENCH Prepared jointly with Lab. Central des Ponts et Chaussees, Paris
Avail: NTIS

A facility for studying the behavior of some road structures during freezing and thawing periods was constructed at Caen (France). The installation is described and some results obtained during a first experiment on the facility performance as well as on the penetration of the frost through the road structures are presented. ESRO

N72-15249# ARO, Inc., Arnold Air Force Station, Tenn.
FURTHER EVALUATION OF A NEW FACILITY CONCEPT FOR TESTING LARGE ABLATION MODELS AT HIGH STAGNATION PRESSURES Final Report, 1 Jul. 1970 - 30 Jun. 1971
R. T. Smith and J. C. Pigott AEDC Oct. 1971 73 p refs
(Contract F40600-72-C-0003; AF Proj. 8950)
(AD-731142; AEDC-TR-71-212; ARO-PWT-TR-71-153) Avail: NTIS CSCL 14/2

The report presents the results of the third phase of an investigation to determine the feasibility of extending ablation test facility capability by surrounding the high enthalpy flow with a coaxial cold jet. The technique was applied to the 5-MW arc heated facility at pressures up to 80 atm. A variety of data probes and models were used to determine flow-model interactions. Final results show that the technique simulates flow satisfactorily over very large ablation models. Author (GRA)

N72-15250# ARO, Inc., Arnold Air Force Station, Tenn.
AN ANALYTICAL MODEL FOR PREDICTING THE PERFORMANCE OF AN EXHAUST GAS COOLING SYSTEM Final Report, Jul. 1970 - Mar. 1971
John McLemore Pelton AEDC Oct. 1971 84 p refs
(Contract F40600-72-C-0003; ARO Proj. RW2116)
(AD-731140; AEDC-TR-71-194; ARO-ETF-TR-17-138) Avail: NTIS CSCL 14/2

A typical system for removing exhaust gases from an altitude test cell consists of cooling the exhaust gases in water spray coolers and removing the saturated exhaust stream by means of mechanical pumping machinery. The spray cooling system may consist of a cooling chamber immediately downstream of the test cell where atomized water is mixed with hot exhaust gases to cool by saturation and dehumidification and a second cooling chamber of similar construction immediately upstream of the exhaust pumping machinery for additional cooling by dehumidification. An analytical model of such a system is presented that develops the mathematical relationship between the two spray cooling chambers and the required pumping machinery parameters and the required engine conditions. Then by varying the cooling water flow rate, velocity, and temperature at separate coolers in the model and specifying the maximum desired duct temperature, it is possible to predict those conditions that will give a minimum cooler inlet pressure. Several typical conditions are investigated using the analytical model to show the influence of cooling water parameters on the test cell pressure. Author (GRA)

N72-15251# General Motors Research Labs., Warren, Mich. Manufacturing Development.
MEASUREMENTS OF DYNAMIC PROPERTIES OF MATERIALS. VOLUME 2: EXPERIMENTAL METHODS AND TECHNIQUES Final Report
Douglas R. Christman, William M. Isbell, Stephen G. Babcock, Allan R. McMillan, and Sidney J. Green Aug. 1971 77 p refs
(Contract DASA01-68-C-0114)
(AD-730750; MSL-70-23-Vol-2; DASA-2501-2) Avail: NTIS CSCL 14/2

Experimental methods and techniques for studying the dynamic response of materials are discussed. Descriptions cover uniaxial and multiaxial stress testing at strain rates up to 1,000/sec, temperatures up to 4000C and heating rates up to 10,000C/sec; measurements of elastic constants as functions of temperature (up to 300C) and pressure (up to 10 kbars); flat-plate impact techniques for uniaxial strain testing at impact velocities up to 8 mm/microsec; hugoniot equation of state measurements with x-cut quartz gages and streak camera; wave profile studies using laser velocity interferometer, manganin gage, slanted resistance wire and magnetic wire techniques; and spall fracture studies using active (free surface velocity vs. time) and recovery (metallographic examination) methods. Where appropriate, data reduction and analysis procedures are described. Author (GRA)

N72-15252# Illinois Univ., Urbana. Aviation Research Lab.
A FLIGHT DYNAMICS EVALUATION OF A SINGER-LINK GAT-2 AS A QUASI-SIMULATOR WITH CONTROL MODIFICATIONS M.S. Thesis
Stewart A. Stoddart Jun. 1971 78 p refs
(Contract F44620-70-C-0105; AF Proj. 9778)
(AD-731135; ARL-71-13/AFOSR-71-4; AFOSR-71-2585TR) Avail: NTIS CSCL 14/2

The flight dynamics of a Singer-Link General Aviation Trainer-2 (GAT-2) are analyzed theoretically and experimentally to determine the fidelity of the simulation of a light twin-engine airplane. The simulation is shown to be reasonable for experimental purposes. Four control modifications, sideslip compensation, lift compensation, position-position roll correspondence, and follow-up trim, are presented and documented.
Author (GRA)

N72-15253# Atmospheric Sciences Office, White Sands Missile Range, N.Mex.
PROJECT GUN PROBE CAPTIVE IMPACT TEST RANGE
L. Edwin Williamson Fort Monmouth, N. J. ECOM Mar. 1971 37 p
(AD-731209; ECOM-5369; OSD-1366) Avail: NTIS CSCL 04/1

The report describes the newly completed Captive Impact Test Range at White Sands Missile Range, which is used in support of the Atmospheric Sciences Laboratory's Meteorological Gun Probe Sounding Programs. The report covers, in two sections, the use of the range as a captive test range and its use as a high-velocity, destructive impact range.
Author (GRA)

N72-15254# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRCRAFT GUIDED MISSILE SUBSYSTEMS Final Report
1 Sep. 1971 25 p
(AMCR Proj. 310-6)
(AD-731189; MTP-7-2-011) Avail: NTIS CSCL 14/2

The procedure provides guidance for conducting engineering tests of aircraft guided missile subsystems, with references for the testing of subsystem components.
Author (GRA)

N72-15255# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
PREDICTION OF THE SLOPE-CLIMBING CAPABILITY OF ELASTIC-RIM WHEELS Final Report
Klaus W. Wiendieck Sep. 1971 55 p refs
(Task-1T061102-B-52-A-01)
(AD-731205; AEWES-TR-M-71-6) Avail: NTIS CSCL 13/6

A new semiempirical approach was attempted to predict the slope-climbing capability of wheels. The approach consisted of determining the pull performance of flexible wheels on yielding slopes by two extrapolations: one starting from the theoretically known pull performance of flexible wheels on unyielding slopes, and the other from experimentally determined performance of rigid wheels on yielding, level ground. The result is a prediction equation for the available pull of elastic-rim wheels (as a particularly simple case of pneumatic tires) on deformable, inclined soils in terms of soil deformability, cohesion, and internal friction; wheel flexibility and load; and slope angle.
Author (GRA)

N72-15256# ARO, Inc., Arnold Air Force Station, Tenn.
PRELIMINARY DESIGN OF A MECHANICAL DRAFT COUNTERFLOW COOLING TOWER Final Report
R. L. Clouse Arnold Air Force Station, Tenn. AEDC Oct. 1971 44 p refs
(Contract F40600-72-C-0003; ARO Proj. BE2151-A11)
(AD-731193; AEDC-TR-71-213; ARO-ETF-TR-71-162) Avail: NTIS CSCL 13/1

The need for a method whereby the preliminary design of a cooling tower can more easily be specified has existed for many years. The numerical techniques commonly used to solve the Merkel cooling tower equation are not adaptable to a direct general solution. This report presents a direct solution to the Merkel equation which, when combined with certain detailed experimental data by others, yields a relatively quick and straightforward method of establishing the preliminary design of a mechanical-draft counterflow cooling tower. Special attention is devoted to cooling tower application relative to high altitude engine test facilities.
Author (GRA)

N72-15829 Endevco Corp., Pasadena, Calif.
DEVELOPMENT OF 100000 g TEST FACILITY
Robert L. Bell *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 205-214 refs
(See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-15838 Tustin Inst. of Tech., Santa Barbara, Calif.
A SURVEY OF PRACTICAL PROBLEMS ENCOUNTERED IN REPRODUCING THE CAPTIVE FLIGHT ENVIRONMENT BY MEANS OF SHAKERS AND SHOCK TEST MACHINES
Wayne Tustin *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 61-66 refs
(See N72-15833 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-15857 Boeing Co., Seattle, Wash.
DYNAMIC DATA ANALYSIS SYSTEM
Michael O. Michellich *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt 7 Dec. 1969 p 115-121 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N72-15257 Ohio State Univ., Columbus.
HYPERSONIC VISCOUS INTERACTIONS AS DESCRIBED BY THE BINARY COLLISION SCALING PARAMETER Ph.D. Thesis
Donald James Harney 1970 125 p
Avail: Univ. Microfilms Order No. 70-26299

The interaction between the inviscid flow field and the large viscous boundary layer characteristic of hypersonic flow is analyzed from the continuum viewpoint. Within the framework of hypersonic small disturbance theory for the viscid flow, the boundary layer may be described in terms of a reference-property Reynolds number. This, in turn, may be transformed to a variety of similarity parameters that correlate viscous flows over slender bodies at hypersonic Mach numbers.
Dissert. Abstr.

N72-15258 Northwestern Univ., Evanston, Ill.
A KINETIC THEORY ANALYSIS OF THE EVOLUTION OF SHOCK, THERMAL, AND EXPANSION WAVES GENERATED BY AN IMPULSIVELY MOVED, FRACTIONALLY ACCOMMODATING PISTON Ph.D. Thesis
Karl Harry Hellman 1970 229 p
Avail: Univ. Microfilms Order No. 71-1864

The development of shock, thermal, and expansion waves

generated by an impulsively moved, fractionally accommodating piston is studied. All gasdynamic properties are assumed to depend upon only one space variable, and time. A kinetic theory approach is used, with the Boltzmann equation as the governing equation. The resulting set of differential equations for the moments are solved numerically by the method of characteristics. Results are presented that show the effect of the accommodation coefficient, the piston temperature, and the piston velocity on the development of the flow field from the earliest times to its fully developed state. Dissert. Abstr.

N72-15259 California Univ., Berkeley.
LAMINAR SUPERSONIC FLOW IN NEAR WAKES AT HIGH VALUES OF REYNOLDS NUMBER Ph.D. Thesis
Mohammad Yousuff Hussaini 1970 64 p
Avail: Univ. Microfilms Order No. 71-790

The studies of subsonic and supersonic wake flows are reviewed. A systematic technique of obtaining non-similar solutions to the boundary layer equations governing the laminar compressible mixing behind a finite base is developed and applied to the case of supersonic base flow. Chapman's similarity solution emerges as the first term in the asymptotic expansion. The analysis takes into account the finiteness of the base, eliminates the infinite velocity of slip at the base present in Chapman's solution, and predicts reverse flow in the dead-air region. Dissert. Abstr.

N72-15260 Polytechnic Inst. of Brooklyn, N.Y.
A TIME DEPENDENT SOLUTION FOR THE FLOW OF CHEMICALLY REACTING GAS MIXTURES ABOUT BLUNT BODIES Ph.D. Thesis
Charles Lee Kyriss 1970 242 p
Avail: Univ. Microfilms Order No. 70-26075

Numerical method for determining the inviscid, hypersonic flow of chemically reacting gases about blunt bodies is developed which solves the direct problem, accurately and economically. The steady state solution is found by solving a mixed set of steady state and time dependent equations. In this method the governing equations are divided into two groups, according to their characteristics, and solved in an iterative cycle. Dissert. Abstr.

N72-15261# Technische Univ., Berlin (West Germany).
CONTRIBUTION TO THE QUASI-ROTATIONAL SYMMETRICAL CALCULATION OF THREE DIMENSIONAL FLOW IN AXIAL BLADINGS CONSIDERING BLOCKING Ph.D. Thesis [BEITRAG ZUR QUASIROTATIONSSYMMETRISCHEN BERECHNUNG DER DREIDIMENSIONALEN STROEMUNG IN AXIALEN BESCHAUFELUNGEN UNTER BERUECKSICHTIGUNG DER VERSPERRUNG]
Jean Hourmouziadis 1971 98 p refs In GERMAN
Avail: NTIS

A general dimensionless form of the radial pressure equation is developed and used in an approximative theorem for blade pressure to calculate the cascade flow. Comparison of calculated and measured flow values shows that: A generalized radial pressure equation represents the actual flow dynamics inside the axial fold only insufficiently because radial velocity is neglected; blade force exerts a strong effect on the radial pressure gradient inside the cascade; variable radial pressure gradient and profile form determine axial velocity distribution; and cascade produced perturbations diminish quickly in front and after the cascade. It is concluded that blade positioning is of utmost importance on cascade flow. Transl. by G.G.

N72-15262# Technische Hogeschool, Eindhoven (Netherlands).
THE HEAT TRANSFER OF A GAS WITH VIBRATIONAL RELAXATION NEAR THE REAR WALL OF A SHOCK TUBE Ph.D. Thesis [DE WARMTE-OVERDRACHT VAN EEN GAS MET VIBRATIERELAKSATIE NAAR DE SCHOKBUISACHTERWAND]
Peter Hubert Maria Jongen 21 Sep. 1971 115 p refs In DUTCH; ENGLISH summary
Avail: NTIS

Heat flux to the end wall of the shock tube after shock wave reflection in a polyatomic gas is considered. The study is limited to those conditions behind the reflected shock wave which give rise to two non-equilibrium phenomenas: the heat flux to the end wall and vibrational relaxation. The relaxation effects are linearized. The results of the calculations are in accordance with the conclusion stating that for Mach numbers of the incoming shock wave below 2, the relaxation in front of the shock wave dominates the relaxation behind so that the pressure at the wall increases immediately after reflection. The weight of the relaxation upon the heat flux depends on the magnitude of the thermal accomodation coefficient in the vibrational energy. Author

N72-15263*# Scientific Translation Service, Santa Barbara, Calif.
FLOW SEPARATION IN CONICAL DIFFUSORS
L. G. Golovina, M. Ye. Deych, A. Ye. Zaryankin, and V. V. Ett Washington NASA Jan. 1972 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), v. 14, no. 1, 1971 p 98-103
(Contract NASw-2035)
(NASA-TT-F-14089) Avail: NTIS CSCL 20D

A detailed study is presented of the flow structure in the inlet section of diffusor, where the transition from a cylindrical channel to a conical channel occurs. The effect of the aperture angle of the diffusor on the occurrence of flow separation is noted, as well as the existence of a considerable nonuniformity of the flow in the transverse direction. It is shown that the local positive pressure gradients in the diffusor in the presence of a corner bend or a section of great steepness at the inlet may be significantly greater and the actual velocity profile may be more deformed than the results of a calculation based on mean flow rates indicate. Author

N72-15264*# General Applied Science Labs., Inc., Westbury, N.Y.
CALCULATION OF TURBULENT BOUNDARY LAYERS WITH HEAT TRANSFER AND PRESSURE GRADIENT UTILIZING A COMPRESSIBILITY TRANSFORMATION. PART 2: CONSTANT PROPERTY TURBULENT BOUNDARY LAYER FLOW WITH SIMULTANEOUS MASS TRANSFER AND PRESSURE GRADIENT
J. Boccio and C. Economos Washington NASA Jan. 1972 42 p refs
(Contract NAS1-9624)
(NASA-CR-1924; GASL-TR-748-Pt-2) Avail: NTIS CSCL 20D

An analysis of the incompressible turbulent boundary layer, developing under the combined effects of mass transfer and pressure gradient, is presented in this paper. A strip-integral method is employed whereby two of the three governing equations are obtained by integrating the combined momentum and continuity equation to 50 percent and 100 percent, respectively, of the boundary-layer height. The latter equation is the usual momentum-integral equation; the former equation requires specification of shear. Accordingly, Clauser's equilibrium eddy-viscosity law is assumed valid at this point. The third and final equation is obtained by specifying that Stevenson's velocity profiles apply throughout the domain of interest, from which a skin-friction law can be derived. Comparisons of the numerical results with the experiments of McQuaid, which include combined effects of variable pressure gradient and mass transfer, show good agreement. Author

N72-15265*# United Aircraft Corp., East Hartford, Conn.
EXPLORATORY STUDY OF THE EFFECTS OF INJECTION CONFIGURATIONS AND INLET FLOW CONDITIONS ON THE CHARACTERISTICS OF FLOW IN SPHERICAL CHAMBERS
Bruce V. Johnson Washington NASA Jan. 1972 40 p refs
(Contract NAS3-13446)

(NASA-CR-1965; K910963-14) Avail: NTIS CSCL 20D

Flow visualization studies were conducted to evaluate techniques for injecting simulated-fuel and simulated-propellant gases into a spherical cavity for application to open-cycle gaseous-core nuclear rockets. Preliminary studies were conducted with six simulated-fuel injectors and eight simulated-propellant injection configurations. Additional tests were conducted with the best configuration to determine the effect of weight-flow ratio, gas density ratio, injector location, and flow distribution on the simulated-fuel containment characteristics. Author

N72-15266*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN IMPLICIT FINITE DIFFERENCE SOLUTION TO THE VISCOUS RADIATING SHOCK LAYER WITH STRONG BLOWING Ph.D. Thesis

Lloyd Bernard Garrett (North Carolina State Univ., Raleigh) 1971 178 p refs

(NASA-TM-X-67584) Avail: NTIS CSCL 20D

An implicit finite difference scheme is developed for the fully coupled solution of the viscous radiating stagnation line equations, including strong blowing. Solutions are presented for both air injection and carbon phenolic ablation products injection into air at conditions near the peak radiative heating point in an earth entry trajectory from interplanetary return missions. A detailed radiative transport code that accounts for the important radiative exchange processes for gaseous mixtures in local thermodynamic and chemical equilibrium is utilized. Author

N72-15267# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.

CAVITATION DAMAGE AT ELEVATED TEMPERATURE AND PRESSURE

F. G. Hammitt and N. R. Bhatt Jan. 1972 8 p refs To be presented at the 1972 ASME Cavitation Forum, Mar. 1972 Supported in part by Westinghouse Elec. Corp. and by Worthington Pump Intern.

(Grant NSF GK-1889)

(UMICH-01357-11-INT-Mod-1) Avail: NTIS

The effects of vibratory cavitation on single steel alloy in water for temperatures ranging from room temperature to about 300 degrees F and pressures up to 100 pounds per square inch gage are discussed. The operation of a test facility which permits cavitation tests to be conducted at various temperatures and pressures and with fluids other than water is described. The mean depth of penetration rate is plotted against temperature and pressure for brass material. Author

N72-15268# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.

CAVITATION WITHIN AN IMPINGING LIQUID DROPLET

Y. C. Huang and F. G. Hammitt Jan. 1972 11 p

(Grant NSF GK-730)

(UMICH-03371-15-I) Avail: NTIS

Two possible mechanisms of cavitation inception within an impinging liquid droplet are described. The first is based on the rapid radial outflow of the liquid during the impact, as the axial liquid motion, arrested by the solid surface, is deflected into radial outward flow. This outward flow results in a reduction in pressure within the droplet. Should the pressure fall below the vapor pressure of the liquid, cavitation may occur. Should it fall below the tensile strength of the liquid, rupture will surely occur within the droplet. Another possible mechanism of cavity formation within a droplet is due to the release of compression waves (generated by the impact) as they reflect from the top surface of the droplet. These negative pressure waves move through the droplet toward the impact surface. Cavity formation through the action of these mechanisms has been observed in a numerical study. Author

N72-15269# Advisory Group for Aerospace Research and Development, Paris (France).

TABLES OF INVISCID SUPERSONIC FLOW ABOUT CIRCULAR CONES AT INCIDENCE, GAMMA EQUALS 1.4, PART 3

D. J. Jones (Natl. Aeron. Estab., Ottawa Ontario) and W. J. Rainbird, ed. (Carleton Univ.) Dec. 1971 172 p refs

(AGARDograph-137-PT-3; AGARD-AG-137-71-PT-3; UDC-533.696.4:533.6.011.5:083) Avail: NTIS

Tabulated results are presented for half cone angles of 45, 47.5, 50, 52.5, and 57 degrees with Mach numbers ranging from 3 to 20. Author

N72-15270# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.

EXPERIMENTAL STUDY OF JETS AT THE BASE OF CYLINDERS AT FLOWING MACH NUMBER 17 [ETUDE EXPERIMENTALE DE JETS AU CULOT DE CYLINDRES PLACES DANS UN ECOULEMENT A MACH 17]

Christian Bisch and Jean Broggi Oct. 1971 44 p refs In FRENCH

(Rept-71-4) Avail: NTIS

Hypersonic (Mach 17) near wake of an hemisphere-cylinder including base injection is investigated. Impact pressure measurements allow to deduct analytical relations between characteristical points of the pressure curve along the centerline of the wake. In addition, mass spectrometer measurements are used in order to show an original form of the argon concentration in the hypersonic nitrogen near wake. Author

N72-15271*# Translation Consultants, Ltd., Arlington, Va.

TESTING AT S1.MA FOR BASIC INVESTIGATIONS ON JET INTERACTIONS. DISTRIBUTION OF PRESSURES AROUND THE JET ORIFICE

A. Soullier Washington NASA Jan. 1972 97 p Transl. into ENGLISH of "Essais a S1.MA pour Recherches de Base sur les Interactions de Jet. Repartition des Pressions Autour de l'Orifice du Jet" Rept. ONERA-1/253-GY-Pt-1/5 ONERA, Chatillon, France, Apr. 1968 97 p

(Contract NASw-2038)

(NASA-TT-F-14066; ONERA-1/253-GY-PT-1/5) Avail: NTIS CSCL 20D

Findings concerning the distribution of pressures around an orifice through which a jet is discharged perpendicular to a flow are reported. Results clearly reveal the reversal in direction of the pitch moment during variation of the relative velocity of the jet with respect to the velocity of the flow. Author

N72-15272*# Translation Consultants, Ltd., Arlington, Va.

TESTING AT S1.MA FOR BASIC INVESTIGATIONS ON JET INTERACTIONS: DISTRIBUTION OF PRESSURES AND VELOCITIES IN THE JET USING THE IDEAL STANDARD NOZZLE (IN UNHEATED STATE)

A. Soullier Washington NASA Jan. 1972 72 p Transl. into ENGLISH of "Essais a si. ma pur Recherches de Base sur les Interactions de Jet. Repartitions des Pressions et des Vitesses dan let Jet Tuyere Type Ideale (A Froid)," Office National d'Etudes et de Recherches Aerospatiales, Chatillon, doc. no. 1/253-GY-Pt-2/5, May 1968 72 p

(Contract NASw-2038)

(NASA-TT-F-14072; Rept-1/253-GY-Pt-2/5) Avail: NTIS CSCL 20D

Results of pressure and velocity measurements carried out in a jet discharging perpendicularly to a flow are presented. Author

N72-15273*# Techtran Corp., Glen Burnie, Md.

EFFECT OF WING TIP SHAPE ON VORTEX SHEET ROLLING UP

R. Lengendre Washington NASA Jan. 1972 6 p Transl. into ENGLISH from Rech. Aerosp. (France), no. 4, Jul. - Aug. 1971 p 227-228

(Contract NASw-2037)

(NASA-TT-F-14111) Avail: NTIS CSCL 20D

Laws of separation over a whole wing are applied to the

study of straight or moderately sweptback wings. The effect of vortex sheet rolling up can be avoided by tailoring the profile of the trailing edge to the edge of a wing or blade, with constant or zero leading edge sweepback, in such a way as to make a clear distinction between the leading and trailing edges. The associated break phenomena are investigated. Author

N72-15274*# Techtran Corp., Glen Burnie, Md.
EFFECT OF CIRCUMFERENTIAL NONUNIFORMITY OF FLOW DIRECTION ON RESONANCE VIBRATIONS OF COMPRESSOR ROTOR BLADES
V. A. Kulagina Washington NASA Jan. 1972 19 p refs Transl. into ENGLISH from Vliyaniye Okruzhnoy Neravnomernosti Napravleniya Potoka na Rezonansnyye Kolebaniya Lopatok Rabochego Kolesa Kompressora, Lopatochnyye Mashiny i Struinyye Apparaty (USSR), no. 5, 1971 p 96-107
(Contract NASw-2037)
(NASA-TT-F-14107) Avail: NTIS CSCL 20D

The effect is estimated of a circumferential nonuniformity of the flow direction, in front of a compressor wheel, on the amplitude of resonance vibrations of the rotor blades. The effect of the boundary conditions behind the wheel on the intensity of the flow spread in the inlet section of the compressor and on the blade vibrations is shown. Author

N72-15275*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL BOUNDARY-LAYER EDGE MACH NUMBERS FOR TWO SPACE SHUTTLE ORBITERS AT HYPERSONIC SPEEDS
George C. Ashby, Jr. Washington Feb. 1972 32 p refs
(NASA-TN-D-6574; L-8030) Avail: NTIS CSCL 20D

Pitot-pressure profiles and surface pressure measurements have been obtained at four axial stations along the center lines of space shuttle straight-wing and delta-wing orbiters at angles of attack from 20 deg to approximately 60 deg and Mach numbers of 20.3 (helium) and 6.8 (air). The results show that the Mach number at the edge of the boundary layer is best predicted by tangent-cone theory up to shock detachment. Author

N72-15276*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFLUENCE OF THERMAL ANISOTROPY ON BEST-FIT ESTIMATES OF SHOCK NORMALS
R. P. Lepping Dec. 1971 19 p refs Submitted for publication
(NASA-TM-X-65794; X-692-71-493) Avail: NTIS CSCL 20D

The influence of thermal anisotropy on the estimates of interplanetary shock parameters and the associated normals is discussed. A practical theorem is presented for quantitatively correcting for anisotropic effects by weighting the before and after magnetic fields by the same anisotropy parameter h. The quantity h depends only on the thermal anisotropies before and after the shock and on the angles between the magnetic fields and the shock normal. The theorem can be applied to most slow shocks, but in those cases h usually should be lower, and sometimes markedly lower, than unity. For the extreme values of h, little change results in the shock parameters or in the shock normal. Author

N72-15277# Technische Hogeschool, Delft (Netherlands).
AN EXPERIMENTAL INVESTIGATION OF THE EXPANSION FLOW FIELD OVER A DELTA WING AT SUPERSONIC SPEED
W. J. Bannink and G. Nebbeling Sep. 1971 57 p refs
(VTH-167) Avail: NTIS

An experimental investigation has been made of the inviscid flow field on the expansion side of a flat delta wing with a semi-apex angle of 45.3 deg and at an angle of incidence of 12 deg. The measurements were performed at a Mach number of 2.94 in a 15 cm x 15 cm blow down wind tunnel. A comparison of measurements performed in different planes normal to the root chord showed that the flow may be considered as conical. The obtained results suggest that the conical-sonic line and the inboard shock wave meet in a point well inside the central region of the flow field (in this region the influence of both halves of the delta wing is felt). The present measurements indicate that, away from the wing surface, the inboard shock wave bends towards the plane of symmetry of the wing. A flow model is discussed based on the present investigations. Author

N72-15278# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
NUMERICAL SOLUTIONS OF FLOW BETWEEN ROTATING CYLINDERS
B. E. Launder and W. M. Ying Oct. 1971 13 p refs
(EF/TN/A/42) Avail: NTIS

Solutions are presented for problems of laminar flow of a Newtonian fluid between cylinders with noncoincident axes, where the core cylinder rotates about its axis. The solutions were obtained by means of a finite difference procedure. The results show that the inclusion of convective transport terms may have an appreciable affect upon the flow field and, in particular, upon the pressure field around cylinders. Author

N72-15279# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
FLUIDICS IN JAPAN AND THE SOVIET UNION
K. S. Nystroem and G. Lundstrom 1971 78 p refs
(FFAP-A-227) Avail: NTIS

The state-of-the-art of fluidics in Japan and the Soviet Union is considered. Summaries of papers presented at the Fifth National Fluidics Symposium of Japan are presented and the exhibition is briefly described. The results of a visit to the Institute of Control Sciences in Moscow are also described. It is concluded that Japan will become important in fluidics in the 1970's, especially in low cost pneumatic devices but also in advanced liquid driven fluidic devices for process control. The applications of fluidics in the Soviet Union were found to be limited. The more widespread work on applications in Japan is contributed to know how and to license agreements from the U.S.A. The main scientific work in fluidics in both countries is centrally directed, government funded, and is close in quality to the work being done in Europe and the U.S.A. N.E.N.

N72-15280*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A NUMERICAL STUDY OF DISPLACEMENT BODY AND CURVATURE EFFECTS ON INCOMPRESSIBLE AND COMPRESSIBLE LAMINAR BOUNDARY LAYERS Ph.D. Thesis - Va. Polytechnic Inst.
Stephen Fay Wornom May 1971 218 p refs
(NASA-TM-X-67593) Avail: NTIS CSCL 20D

This technique has been applied to study such effects on incompressible flow around cylinders at moderate to low Reynolds numbers and for compression ramps at hypersonic Mach numbers by employing a finite difference method to obtain numerical solutions. The results indicate that the technique can be applied successfully in both regimes and does predict the correct trend in regions of large curvature and displacement body effects. It was concluded that curvature corrections should only be attempted in cases where all displacement effects can be fully accounted for. Author

N72-15281# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE POPULATION INVERSION OF CO2 MOLECULES IN EXPANDING GAS FLOWS
N. A. Generalov, G. I. Kozlov, and I. K. Selezneva [1971] 13 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekhn. Fiz. (USSR), no. 5, 1971 p 24-34
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A system of hydrodynamics equations is solved numerically in combination with the kinetic equations of excitation of the

vibrational degrees of freedom of molecules to describe the escape of molecular mixtures from a nozzle. It is determined that under definite conditions a population inversion of the carbon dioxide molecules in the mixture will originate at the nozzle exit. The magnitude of the inversion depends on both the nozzle configuration and the initial values of the gas temperature and pressure. Author

N72-15282# Technische Hogeschool, Delft (Netherlands).
TIME DEPENDENT MASS TRANSFER FROM SINGLE BUBBLES Ph.D. Thesis
Jan Tomas Lindt 1971 128 p refs
Avail: NTIS

An analysis has been carried out of the physical and chemical mass transfer processes that develop when a single bubble rises in a non-degassed stagnant liquid. The system in which carbon dioxide is absorbed in an aqueous buffer solution has been used. The pseudo first order rate constant for the liquid phase chemical reaction was varied by adjusting the concentration of sodium arsenite catalyst, with the absence of catalyst being used to provide the datum whereby the system could be regarded as being entirely physically controlled, the reaction rate being extremely slow under these conditions. In this way experimental data on physical and chemical absorption were obtained under very similar physical conditions. The experimental technique provided accurate information on the instantaneous mass transfer rates from and velocities of the bubble. Author

N72-15283# Technische Hogeschool, Delft (Netherlands).
THE ORIGIN OF BUBBLES IN FLUIDIZED SYSTEMS Ph.D. Thesis
Jan Verloop 1971 107 p refs
Avail: NTIS

The origin of bubbles in fluidized systems is discussed. The approach is based on the concept that bubbles are the results of some process occurring in the homogeneous fluidized state. The analysis starts with the minimum fluidization velocity. The conditions at the onset of fluidization are characteristic of homogeneous fluidization. Special attention is paid to the influence of interparticle forces. Author

N72-15284# Oxford Univ. (England). Dept. of Engineering Science.
SKIN FRICTION MEASUREMENTS IN LAMINAR AND TURBULENT FLOWS, USING HEATED THIN FILM GAUGES
R. J. Pope 18 Jan. 1972 23 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Jun. 1972
Avail: NTIS

An analysis of the calibration behaviour of thin-film heated element gauges in both laminar and turbulent flow has been performed. Attention is paid to the possible effects due to wall temperature distribution changes, which are discounted, and the effect of turbulence on viscosity, conductivity, and the average velocity profile in the wall region. The theory leads to a correction that can be applied to turbulent data to reduce them to the same calibration as that obtained in laminar flow. A criterion is developed for agreement, within limits, of the calibrations from the two flow regimes. From this it is possible to predict that the effects of turbulence are negligible in water flows but noticeable in air flows for specific gauges. Author

N72-15285# Los Alamos Scientific Lab., N.Mex.
FLUID DYNAMICS: A LASL MONOGRAPH
Francis H. Harlow and Anthony A. Amsden Jun. 1971 115 p refs Supersedes LA-4100
(Contract W-7405-eng-36)
(LA-4700; LA-4100-Rev) Avail: NTIS

A discussion of basic physical fluid dynamics shows some useful techniques for obtaining solutions, and illustrates a variety of fluid flow phonemena by means of some solved problems. No prior fluid dynamics experience is required of the reader. Topics include derivation of the equations, an examination of their properties, a simplified discussion of molecular dynamics as related to fluid flows, a study of rarefactions and shocks, some compressible-flow solutions, some incompressible-flow solutions, and an introduction to numerical methods for high-speed computers. Author (NSA)

N72-15286# Atomic Energy Commission, Washington, D.C.
INVESTIGATIONS OF THE PROFILES OF SPEED IN THE ENTRANCE SECTOR OF A DENSELY PACKED CLUSTER OF RODS
V. I. Subbotin, P. A. Ushakov, Y. D. Levchenko, and L. N. Bibikov [1971] 22 p Transl. into ENGLISH from Russian report
(AEC-tr-7181; TID-4500) Avail: NTIS

Velocity profiles at the entrance region of rod cluster were investigated. The measurements were carried out in a wind tunnel in which the air flow was created by a 2100 rpm centrifugal fan that developed an output of 10,000 cu m/hr. The analysis of experimental data permitted the velocity profiles along the axis of symmetry of the channel to be determined. NSA

N72-15287# Sandia Labs., Albuquerque, N.Mex.
STUDY OF LONGITUDINAL SHOCK WAVES OF FINITE AMPLITUDE IN NONLINEAR ELASTIC MATERIALS STARTING FROM THE SYSTEM OF ISENTROPES
Jean Boistel deBelloy Apr. 1971 41 p refs Transl. into ENGLISH from J. Mec. (France), v. 9, no. 2, 1970 p 277-307 Sponsored by AEC
(AEC-tr-7262) Avail: NTIS

A study of longitudinal shock waves of finite amplitude in non linear hyperelastic materials is reported. The diverse forms of the isentropes allow one to distinguish as many types of materials, and in accordance with certain combinations of hypotheses different cases are envisaged. By constructing the Hugoniot curve and a contour which is in accordance with the second law of thermodynamics and Lax's criterion of stability the solutions can be seen; thus it becomes possible to observe, for each case, relaxation shocks, compression shocks, and double waves composed of a single isentropic wave followed or preceded by a discontinuity. The study of a more complex type of material poses a problem of a more general order. Author

N72-15288# Colorado State Univ., Fort Collins. Engineering Research Center.
FLUXES OF HEAT, MOMENTUM AND TRACERS IN WIND AND WATER TUNNELS Progress Report, 1970-1971
J. Gessler and S. Karaki May 1970 93 p refs
(Contract AT(11-1)-1813)
(COO-1813-3) Avail: NTIS

Turbulence and particle diffusion in the air boundary layer above water waves, dispersion at the air-water interface, and diffusion in a body of water are considered. The fluid mechanics of the air-water interaction is discussed in relation to the problem of particle diffusion in the atmosphere above water surfaces. Far above the surface little influence is registered by the waves, therefore the study was limited to the near field. The turbulent air flow field is taken into account. Author

N72-15289# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Aerodynamik.
WALL TEMPERATURE EFFECTS ON SUBSONIC GAS FLOW
W. J. Kelnhofer Nov. 1970 59 p refs
(DLR-FB-70-66; AVA-FB-7043; DK-532.526.4; DK-533.6.011.6)
Avail: NTIS; ZLDI Munich: 14,60 DM

A theoretical study is made for calculating various turbulent boundary layer thicknesses at a point on a heated or cooled wall assuming n-power velocity and m-power temperature profiles in subsonic gas flow. Also, boundary layer measurements are made for air flowing over a flat plate heated to 250 C with velocities

up to 30 m/s. The experimental results are compared to previous theoretical results assuming n=m and the velocity and thermal boundary layer thicknesses equal in fully developed flow.
Author (ESRO)

N72-15290# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Gasdynamik.
CONSTRUCTION AND CALIBRATION OF A NEW WEDGE PROBE FOR TWO-DIMENSIONAL WAKE FLOW MEASUREMENTS PARTICULARLY IN THE TRANSONIC FLOW REGIME
O. Lawaczeck and J. Mecke Dec. 1970 46 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-69; AVA-FB-7038; DK-533.6.071.3; DK-533.69.048.3) Avail: NTIS; ZLDI Munich: 10,80 DM

A new wedge probe which has been developed for wake flow measurements past two-dimensional transonic cascades is described. It is machined out of high-tensile steel, so that it cannot be damaged by small dust particles in the flow. The probe has been calibrated in a transonic wind tunnel. The results of these calibration measurements and the calibration curves that are derived from these results are given. The probe is to be used in a high speed cascade wind tunnel. Author (ESRO)

N72-15291# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
WEAK VISCOUS INTERACTION ON A SPINNING HOLLOW CYLINDRICAL BODY IN AXIAL, ADIABATIC, SUPERSONIC FLOW
Harry P. Horton Jun. 1971 31 p refs Sponsored in part by Roy. Soc. London and Fonds Natl. de la Rech. Sci. de Belg.
(VKI-TN-74) Avail: NTIS

Analytic expansions in ascending powers of the hypersonic interaction parameter, X, are derived for adiabatic weak viscous interaction on a hollow circular cylinder spinning about its axis, mounted at zero incidence in a supersonic stream, the boundary layer being laminar. It is shown that, in the hypersonic limit, the relation between the local to free-stream Mach number ratio and the interaction parameter is independent of spin rate, if all vectorial quantities appearing in the definition of the interaction parameter are resolved in the direction of the free-stream relative to an observer fixed to the rotating surface. A perturbation scheme is developed which generates exponentially-growing strong interactions, starting from the weak interaction solutions, for use as initial conditions for the calculation of interactions on hollow cylinder-flare configurations. The analogy between the type of flow considered and that on a yawed plate of infinite span is pointed out. Author (ESRO)

N72-15292# Royal Aircraft Establishment, Farnborough (England).
SCALE EFFECTS IN FLOWS OVER SWEPT WINGS
M. G. Hall, D. Kuechemann, and Maskell Mar. 1971 55 p refs Presented at the AGARD meeting on Facilities and Tech. for Aerodyn. Testing at Transonic Speeds and High Reynolds Numbers, Goettingen, West Ger., 26-28 Apr. 1971 Revised
(RAE-TR-71043) Avail: NTIS

A review is given of current knowledge of the effects of variations in Reynolds number on the possible types of flow over a swept wing and the boundaries between them. Three main flow regimes are discussed: (1) the attached boundary layer which may be laminar or turbulent and where the position of transition is important, (2) the thin wake which extends downstream from the trailing edge of the wing; (3) and the regime of separated flow. Their interactions with the external flow and each other are included. The flow structures are threedimensional. Reynolds number effects are best understood where simple extensions from two dimensions can be made. The most serious gaps in understanding are found where compressibility and strong interactions are important. If these gaps could be filled model testing would be much more reliable.
Author (ESRO)

N72-15293# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
SOME ASPECTS OF NON-LINEAR SURFACE WAVE PROPAGATION IN FLUIDS Ph.D. Thesis - Reading Univ., Gt. Brit.
D. A. Tanner Jun. 1971 140 p refs
(NPL-NAC-2) Avail: NTIS

Solitary and cnoidal surface wave profiles are calculated in shallow water, and in viscous fluids. The wave profile equations are established for the case of waves generated by a moving pressure field, and solved for both wave types. Wave profile and wave drag are computed. Equations of motions are established for solitary and cnoidal waves in viscous fluids flowing down an inclined plane, and several magnitudes of the Reynolds and Froude numbers are considered in the solution. ESRO

N72-15294# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Abteilung Aeroakustik und Instabilitaet.
ON THE DISCHARGE CONDITION AT THE TRAILING EDGE OF A NOZZLE IN A WEAK UNSTEADY JET FLOW [UEBER DIE ABFLUSSBEDINGUNG AN DER DUESENAUSTRITTSKANTE BEI EINER SCHWACH INSTATIONAEREN DUESENSTROEMUNG]
D. Bechert and Eberhard Pfizenmaier 1971 36 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-09) Avail: NTIS; DFVLR Porz: 12 DM

The Kutta condition of a weakly nonstationary jet flow, leaving the trailing edge of a nozzle, is investigated. Velocity measurements were done in a jet flow with acoustical perturbation. Hot wire probes and probe microphones were used. The experimental results show no singularity of the nonstationary part of the velocity at the trailing edge of the nozzle as it would occur in the absence of a stationary jet flow. The nonstationary perturbation was found to produce no constant deformation of the jet boundary. Author (ESRO)

N72-15295# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
AN EFFECTIVE VISCOSITY MODEL FOR TURBULENT WALL BOUNDARY LAYERS
J. C. Anyiwo and R. N. Meroney Jun. 1971 34 p refs
(Contract N00014-68-A-0493-0001; NR Proj. 062-414/6-6-68) (AD-731061; CER70-71JCA-RNM63) Avail: NTIS CSCL 20/4

Existing effective viscosity models which have been very valuable in the mean field closure method for turbulent boundary layer computation have shown certain undesirable limitations for certain realistic but general boundary layer flows. The more general flows usually involve non-negligible considerations of pressure gradients and such wall conditions as roughness, curvature and aspiration or transpiration in varying degrees of importance. The effects of these external and wall influences are included in the present model of the effective viscosity which is developed for a general flow. Author (GRA)

N72-15296# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A NUMERICAL SOLUTION FOR FLOW BETWEEN ROTATING AND STATIONARY FINITE DISKS
Donald H. McCoy Jun. 1971 52 p
(RDT/E Proj. 1T5-62603-A-041)
(AD-731217; BRL-1541) Avail: NTIS CSCL 20/4

The velocity field and pressure distribution between stationary and rotating finite disks are obtained by a finite difference solution of the Navier-Stokes equations and the continuity equation using an explicit scheme developed by Chorin. These numerical results are compared with the results of infinite disk solutions. In the range of interest for viscometer applications, the velocity and pressure are adequately represented by the infinite disk solutions. Author (GRA)

N72-15297# Air Force Cambridge Research Labs., Bedford, Mass.
THE MOTION OF TRAILS THROUGH FLUIDS WITH CONSTANT VELOCITY SHEAR
Harry E. Moses 30 Jul. 1971 20 p refs
(Task-763513)
(AD-731172; AFCRL-71-0412; AFCRL-ERP-367) Avail: NTIS CSCL 04/2

Smoke trails are used to find winds in the upper atmosphere. In the present paper, a theoretical study is conducted of the motion of smoke trails in winds of constant shear in the case of potential, vorticity, and stratified flows. Some general considerations of the motion of smoke trails are also given.
Author (GRA)

N72-15298# Hydronautics, Inc., Laurel, Md.
OBSERVATIONS ON LONG WAVES SWEEPING THROUGH SHORT WAVES
Jin Wu Apr. 1971 18 p refs
(Contract N00014-70-C-0345; NR Proj. 220-016)
(AD-731368; TR-231-30) Avail: NTIS CSCL 20/4

An experiment is reported which attempted through visual observations of a wind-disturbed water surface to analyze critical conditions in the dynamical process of energy exchange between short and long waves. The models were based on one common phenomenon: long waves sweeping through short waves and causing short waves to break on the forward face of the long wave crests.
Author (GRA)

N72-15299# Hydronautics, Inc., Laurel, Md.
SURFACE CURVATURE OF WIND WAVES OBSERVED FROM DIFFERENT ANGLES
Jin Wu Apr. 1971 27 p refs
(Contract N00014-70-C-0345; NR Proj. 220-016)
(AD-731369; TR-231-31) Avail: NTIS CSCL 20/4

The wind-disturbed water surface consists of waves of various lengths moving at various speeds. There is increasing interest in determining the statistical properties of the microstructure of such a surface. Measurement of the curvature distributions of wind waves viewed from different angles is helpful for understanding nonlinear interaction between ripples and carrier waves, and is important for interpreting reflection and back-scattering from the sea surface. In the present study, both slope and curvature distributions of the disturbed water surface under various wind conditions in a laboratory tank are simultaneously and systematically measured from all inclinations to the mean water surface, but in a plane containing the wind direction and perpendicular to the water surface. Author (GRA)

N72-15300# Ballistic Research Labs., Aberdeen Proving Ground, Md.
HOT-WIRE MEASUREMENTS IN A CYLINDER WAKE FOR LOW REYNOLDS NUMBER FLOW AT MACH 2
Clarence W. Kitchens, Jr. and Clarence C. Bush Aug. 1971 22 p refs
(DA Proj. 1T0-61102-A-33-D)
(AD-730643; BRL-MR-2116) Avail: NTIS CSCL 20/4

A hot-wire anemometer is used to measure the flow field downstream of a circular cylinder in a Mach two freestream. These measurements verify the presence of a wake shock in such flows for Reynolds numbers at low as 157.
GRA

N72-15301# Aerospace Corp., San Bernardino, Calif. Technology Div.
THE SOLUTION OF SHARP CONE BOUNDARY LAYER EQUATIONS IN THE PLANE-OF-SYMMETRY Technical Report, Dec. 1969 - Apr. 1971
John W. Murdock 15 Jul. 1971 57 p refs
(Contract F04701-71-C-0172)
(AD-730598; TR-0172(S2816-60)-1) Avail: NTIS CSCL 20/4

A detailed study has been made of the solutions to cone boundary layer equations in the symmetry plane in order to increase understanding of the mathematical nature and physical meaning of these solution. A typical set of symmetry plane solutions is presented. Included in this set are various solution branches not previously published. A double-valued solution curve is found which has not been studied prior to this time except for one trivial point. The extension of an existing solution branch through a removable singular point has also been accomplished. The solutions presented are categorized according to whether they are dependent on or independent of the boundary layer outside the symmetry plane. The region in which no solutions to the usual symmetry plane equations exist is examined. It is noted that in this region the boundary layer model breaks down and conservation of mass is not satisfied at the symmetry plane. Nonanalytic behavior at the symmetry plane is investigated.
Author (GRA)

N72-15302# Army Foreign Science and Technology Center, Charlottesville, Va.
AN APPROXIMATE SOLUTION OF A PROBLEM OF A TURBULENT BOUNDARY LAYER
A. S. Dorfman and O. D. Lipovetskaya 6 Jul. 1971 14 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 18, no. 2, Feb. 1970 p 224-232
(AD-730477; FSTC-HT-23-1206-71) Avail: NTIS CSCL 20/4

The problem refers to the development of a turbulent boundary layer in an axisymmetric channel with a calculation of the interaction of the boundary layer and the center of the flow. The relationships are obtained for separation points, joining points of the layers, and other characteristics from the Reynolds number and the geometric characteristics of the channel. A simple approximate method of calculation of the boundary flow in a channel with curvilinear generatrix is proposed.
Author (GRA)

N72-15303# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
NONLINEAR RESONANT WAVE MOTION OF A RADIATING GAS
James Edward Eninger May 1971 108 p refs Sponsored in part by NSF
(Contract F44620-69-C-0006; Task-978101)
(AD-730621; SUDAAR-423; AFOSR-71-1908TR) Avail: NTIS CSCL 20/4

A theoretical study is made of the wave motion of a radiating gas confined between two infinite parallel walls. The motion is driven perpendicular to the walls by a radiative flux of harmonically varying intensity. Attention is focused on a resonance phenomenon that occurs when the gas is driven at a frequency that is close to one of the natural acoustic resonant frequencies of the system. Away from these resonant frequencies, for conditions attainable in the laboratory, the response can adequately be described by a simplified theory that neglects gas-dynamic nonlinearities and radiative transfer due to perturbations in spontanous emission from the gas. Near resonance, it is shown that both these effects play an important role. In fact, if they are not taken into account, an invalid infinite response is predicted precisely at resonance. Thus the resonance condition provides an opportunity to study the coupled effects of gas-dynamic nonlinearities and radiative transfer on wave motion. The feasibility of an experiment to test the theoretical results is studied. The experimental device uses a wave tube to contain the gas. The viscous boundary layer on the side wall of this tube can have a significant effect on the wave motion. It is found that in order for this effect to remain small, the diameter of the tube would typically have to be greater than its length.
Author (GRA)

N72-15304# Oceanics, Inc., Plainview, N.Y.
THE STABILITY OF A VORTEX PAIR IN THE PRESENCE OF A GROUND PLANE Final Report
Nicholas R. Rotta Jun. 1971 48 p refs
(Contract F44620-70-C-0106; Task-978102)
(AD-730617; Rept-71-81; AFOSR-71-2486TR) Avail: NTIS

CSCL 20/4

The configuration stability of a vortex pair in the presence of a ground plane is examined. First the motion of a vortex in three dimensions is examined by the method of matched asymptotic expansions in which the solution of the Navier-Stokes equations are constructed asymptotically. The dependence of the velocity and stability of the vortex on factors such as the outer (inviscid) flow field and viscosity in the inner (vortical core) region is clearly established. The proximity of the ground plane enters through the outer solution which is matched to the inner, viscosity dependent, solution. The vortex pair in ground effect is shown to be unstable to disturbances of all wavelengths with increasing amplification rate as the ground is approached. Indications are that the present analysis predicts a more stable (less unstable) vortex system than does the inviscid theory. Comparison of the present analysis, in the limit of zero ground effect, with photographs of vortices undergoing a configuration instability is made. The viscosity necessary for agreement is found to be on the order of the eddy viscosity for the turbulent line vortex, indicating the existence of turbulence in the vortex core. Author (GRA)

N72-15305# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
TWO APPROACHES TO THE THREE-DIMENSIONAL JET IN CROSS WIND PROBLEM: A VORTEX LATTICE MODEL AND A NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS Ph.D. Thesis
Joe Floyd Thompson, Jr. Jun. 1971 272 p refs
(Contract DAHC04-68-C-0004; Proj. Themis)
(AD-730494; AROD-T-2:22-E-Suppl) Avail: NTIS CSCL 20/4

A three-dimensional numerical solution of the time-dependent, incompressible Navier-Stokes equations based on an integro-differential formulation of these equations is developed. With this formulation it is possible to obtain the complete solution in the entire flow field while restricting the actual computational field to the region of significant vorticity magnitude of each time. This allows a considerable reduction in the computer storage required, since only the field points having significant vorticity at any time need be stored at that time, and calculations are actually performed only at those points at that time. The validity of the numerical solution is established by comparison of the results with the exact solution for the time-dependent, one-dimensional flow over a suddenly accelerated infinite flat plate moving parallel to itself at constant velocity, and by comparison of surface pressure and drag coefficients with experimental results and with the results of other numerical solutions for the two-dimensional flow about a circular cylinder. The numerical solution is applied to the flow field of an infinite jet in a cross-flow and to the flow field of a jet issuing perpendicularly from an infinite plane wall into a cross-flow parallel to the wall. Author (GRA)

N72-15818# University of Southern Calif., Los Angeles.
SHOCK ANALYSIS OF FLUID SYSTEMS USING ACOUSTIC IMPEDANCE AND THE FOURIER TRANSFORM; APPLICATION TO WATERHAMMER PHENOMENA
Arthur A. Winquist and Raymond C. Binder *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 67-81 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390: $15.00/set

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N72-15306 Consiglio Nazionale delle Ricerche, Rome (Italy). Commissione Italiana per la Oceanografia.
REPORT OF OCEANOGRAPHIC DATA, 30 APRIL - 30 JUNE 1970 [RACCOLTA DATI OCEANOGRAFICI, 30 APRILE - 30 GIUGNO 1970]
Jul. 1970 27 p refs In ITALIAN
(Oceanog-Ser-A-No-47) Copyright. Avail: Issuing Activity

Preliminary results for the oceanographic trip of the Bannock in the Sicilian and Sardinian channels are reported. Research was accomplished in the following areas: infrared radiomeasurement of the sea surface temperature, large scale heat exchange between the sea and air, atmospheric electricity, condensation nuclei counts, and collection of sea water and vapor samples for studying evaporation by isotopic analysis of hydrogen and oxygen. F.O.S.

N72-15307 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
RECORD OF OBSERVATIONS AT ST. JOHN'S MAGNETIC OBSERVATORY, 1968 - 1969 Publications of the Earth Physics Branch, volume 40, no. 9
G. A. Brown 1971 78 p refs
(M70-40/9) Avail: NTIS Copyright.

The functions and purposes of the St. John's Magnetic Observatory are discussed. The major aim of the Observatory is to control marine and airborne magnetic surveys conducted over the broad continental shelf east of Canada. The data collected are also used for studies of world wide geomagnetic variations. Observations are given in tabular form. E.H.W.

N72-15308*# Lockheed Missiles and Space Co., Palo Alto, Calif. Space Sciences Lab.
LOCKHEED EXPERIMENT ON ATS-5 Quarterly Progress Report, 1 Jun. - 31 Aug. 1971
10 Sep. 1971 16 p
(Contract NAS5-10392)
(NASA-CR-122841; LMSC-D243428; QPR-8) Avail: NTIS CSCL 04A

Results of the coordinated observations of the magnetospheric substorm occurring at 05:30 on 13 February 1970 are presented. Progress in several other areas of analysis of the data from the Lockheed experiment on ATS-5 is outlined. Author

N72-15309# Thessaloniki Univ. (Greece). Div. of Rural and Surveying Engineering.
A STUDY OF TERRESTRIAL REFRACTION IN THE AREA OF THESSALONIKI Ph.D. Thesis [MELETE TIS GEODAITIKES DIATHLASEOS EIS TIN RERIOCHEN THESSALONIKES]
Anastasios L. Papademetrios 1970 152 p refs In GREEK
Avail: NTIS

A theoretical study of the problems in determining the values of the local coefficients of atmospheric refraction near the ground relating to geodetic surveys is presented. The sources of perpendicular thermoregulation, and methods of calculating the angles and the local coefficients of terrestrial refraction under different conditions are discussed. Observations leading to the calculation of the local coefficients for the Thessaloniki area are presented, and the calculated values are analyzed. N.E.N.

N72-15310# Thessaloniki Univ. (Greece). Div. of Rural and Surveying Engineering.
THE EARTH'S GRAVITY FIELD M.S. Thesis
Spyridon Antzoulatos 1968 123 p refs In GREEK
Avail: NTIS

The potential method of calculating the exact shape of the earth is discussed and is used to calculate the shape of the geoid. The potential field created by bodies of different materials is defined, and the application of Gauss and Green formulas and of the Laplace equation based on elliptical coordinates is studied. Both the real and potential gravity field are studied. The gravity field of an ellipsoid surface, the normal dynamic development in

spherical harmonic correlation, and the anomaly of the gravitational field are analyzed. Methods of converting natural gravity measured on the earth surface and of gravity, g, on the geoid surface are examined, and empirical calculations of the geoid are discussed. Equipment and methods used to calculated the gravity, g, are also described. Author

N72-15311# Thessaloniki Univ. (Greece). Div. of Rural and Surveying Engineering.
STUDY OF THE EARTH'S GRAVITY FIELD WITH THE HELP OF OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES M.S. Thesis
Demetrios S. Tsakoumangkos 1969 170 p refs In GREEK
Avail: NTIS

A theory of the terrestrial gravity field is presented based on gravity observations from the earth's surface and on observations of changes in the orbital elements of satellites. The general potential theory is developed using the Laplace equation in spherical and ellipsoid functions, the Legendre polynomials, and the integral formulas of Green, Ganes, and Stokes. The potential of the gravity field is examined, and harmonic functions are developed. A brief general discussion of the satellite motion in a central gravity field according to Kepler's laws is given, and the necessary orbital elements are established. The problem of satellite motion in a noncentral gravity field is then studied, and correlations of the spherical harmonic functions are developed from the orbital data. The harmonic zonal and trapezoidal harmonics and the coordinates of the observation stations are defined. Measurements of the satellite distance from the earth determined by theodolites, photographic tracking, and radio tracking are discussed. Efforts to measure geoid oscillations are reviewed. Author

N72-15312# Thessaloniki Univ. (Greece). Div. of Rural and Surveying Engineering.
METHODS FOR TRACKING ARTIFICIAL EARTH SATELLITES, VOLUME 1 M.S. Thesis
Christos A. Stefanides 1970 217 p In GREEK 2 Vol.
Avail: NTIS

Methods and systems for tracking satellites, and the use of satellites in geodetic surveying are discussed. Orbital and operational purposes of tracking satellites are described, along with various methods of predicting the satellite's position. Tracking satellites with the naked eye or with small telescopes is considered the least accurate and is mainly used for prediction purposes. Details are given on tracking methods employing highly accurate photographic cameras and large astronomical telescopes, and the most widely used cameras are described. Laser beam tracking system is mentioned, and its performance is indicated. The principles of employing Doppler radio signals transmitted from the satellite are considered, and general information on radar tracking and different types of tracking radar is given. Geodetic surveying using Anna 1B and GEOS 1 satellites are also discussed. N.E.N.

N72-15313# Thessaloniki Univ. (Greece). Div. of Rural and Surveying Engineering.
METHODS FOR TRACKING ARTIFICIAL EARTH SATELLITES, VOLUME 2 M.S. Thesis
Christos A. Stefanides 1970 238 p refs In GREEK 2 Vol.
Avail: NTIS

For abstract, see N72-15312.

N72-15314# Thessaloniki Univ. (Greece). Div. of Rural and Surveying Engineering.
AZIMUTH DETERMINATION WITH THE WILD GAK-1 M.S. Thesis
Stauros Chalkias 1970 129 p In GREEK
Avail: NTIS

The gyroscope and its operation are described, and the use of the instrument to determine the azimuth of two distinct directions is reported. Details are given on the gyroscope parts and its converter, battery, and electronic unit. The maintenance activities and the actual operation are outlined. The method of changing points and the method of passage for determining one azimuth are discussed. The methods are then used to determine the azimuth of the two directions defined by two points known from astronomical observation. The results, presented in tabular form, and the instrument's accuracy are discussed. N.E.N.

N72-15315# Thessaloniki Univ. (Greece). Div. of Rural and Surveying Engineering.
A STUDY OF THE ACCURACY OBTAINED WITH THE ELECTROMAGNETIC DISTANCE-MEASURING APPARATUS WILD DISTOMAT Di 10 M.S. Thesis
Philippos Karagianopoulos and Antigone Laskaridou 1971 249 p In GREEK
Avail: NTIS

The Distomat Di 10, its technical characteristics, operation, and use are discussed. The procedure for making necessary corrections for atmospheric conditions is explained, and measurements of known lengths in the proximity of the Mikra Airport are analyzed. The Pearson coefficients of correlation between the various atmospheric conditions (pressure, relative humidity, and temperature) and the length measurements, between the atmospheric conditions and the instrument constant, and between the length measurements and instrument constant are tabulated. Calculations of the spread and the mean square error are also given. It is concluded that the length measurements are slightly affected by weather changes, but are effectively independent of them when necessary corrections are made. A slight correlation between length and instrument constant is noted, and the instrument constant is affected by the temperature. The spread in length values is a minimum between 2:00 and 4:00 pm. N.E.N.

N72-15316# Thessaloniki Univ. (Greece).
ELECTOMAGNETIC DISTANCE MEASURING IN GEODESY (TERRESTRIAL) Ph.D. Thesis
Anthimos G. Bantellas Oct. 1969 157 p refs In GREEK
Avail: NTIS

The application of electronic equipment to geodetic surveying is discussed, emphasizing tellurometers. The shoran-hiran, Decca, geodimeter, and tellurometer systems are reviewed. The designs and electrical requirements of electronic equipment used in geodesy are examined. Details are given on tellurometers, including the MRAs 1, 2, 3, 4, and 101, and also on the Electrotape, Hydrodist, and Distomat. Errors inherent in the distance measuring methods and in the tellurometers are discussed along with corrections and changes which appear to be appropriate. The applications of these methods to surveying over a large area and within an urban area are described. It is felt that the tellurometer and the theodolite used in tandem with the best features of each brought into play will be the most valid representative of modern electronic equipment for geodesy. N.E.N.

N72-15317# National Bureau of Standards, Washington, D.C. Building Research Div.
ENGINEERING ASPECTS OF THE 1971 SAN FERNANDO EARTHQUAKE Final Report
Hai Sang Lew, E. V. Leyendecker, and R. D. Dikkers Dec. 1971 419 p refs Sponsored in part by Office of Emergency Preparedness and Office of Civil Defense
(Proj. 4213116)
(NBS-BSS-40; LC-70-186531; Stock-0303-0940) Avail: SOD $3.00 as C-13.29/40

An engineering survey of the damage to buildings, bridges, and other structures as a result of the California earthquake of February 9, 1971 is presented. Based on the study of the data and observations made during the survey, recommendations are made pertaining to the improvement of building and other structural design and construction practices. Author

N72-15318# National Oceanic and Atmospheric Administration, Boulder, Colo.
TEMPORAL DEVELOPMENT OF THE GEOGRAPHICAL DISTRIBUTION OF AURORAL ABSORPTION FOR 30 SUBSTORM EVENTS IN EACH OF IQSY (1964-1965) AND IASY (1969)
F. T. Berkey (Geophys. Inst., Alaska), V. M. Driatskiy (Arctic and Antarctic Res. Inst., Leningrad), K. Henriksen (Auroral Obs., Tromsoe, Norway), D. H. Jelly (Commun. Res. Centre, Ottawa), T. I. Shchuka (Arctic and Antarctic Res. Inst., Leningrad), P. Theander (Kiruna Geophys. Inst., Sweden), and J. Yliniemi (Oulu Univ., Finland) Sep. 1971 135 p refs
(UAG-16) Avail: SOD $0.70 as c55.220:16

Thirty auroral absorption events during each of the IQSY and IASY periods were analyzed in detail, and 369 synoptic maps were produced for IQSY and 336 for IASY. These maps show the temporal development of the high energy auroral particle precipitation over the Northern Hemisphere. The maps are presented in order to make them available to the scientific community for use in connection with related observations and measurements of other kinds. Author

N72-15319# National Oceanic and Atmospheric Administration, Boulder, Colo.
DATA ON SOLAR-GEOPHYSICAL ACTIVITY ASSOCIATED WITH THE MAJOR GEOMAGNETIC STORM OF 8 MARCH 1970, PART 2
J. Virginia Lincoln and Dale B. Bucknam, comps. Apr. 1971 136 p refs
(UAG-12-Pt-2) Avail: NTIS

Aspects of ionospheric phenomena, airglow, and auroras are considered. Among the topics presented are analyses of electron content, periodic fluctuations, scattering, and radio wave and Doppler observations. K.P.D.

N72-15320# National Oceanic and Atmospheric Administration, Boulder, Colo.
DATA ON SOLAR-GEOPHYSICAL ACTIVITY ASSOCIATED WITH THE MAJOR GEOMAGNETIC STORM OF 8 MARCH 1970, PART 3
J. Virginia Lincoln and Dale B. Bucknam, comps. Apr. 1971 157 p refs
(UAG-12-Pt-3) Avail: NTIS

Topics in the areas of cosmic rays, geomagnetism, and the interplanetary magnetic field are presented. Data are given in graphic form. K.P.D.

N72-15321# Office of Naval Research, Arlington, Va.
REPORT AVAILABILITY NOTICE: FALL 1971
1971 106 p refs
(AD-730015; ONR-ACR-177) Avail: NTIS CSCL 08/10

The following general topics are discussed: Environmental factors affecting the propagation of acoustic energy; Acoustic and engineering properties of the ocean floor; Magnetic, gravity, and radiation fields in the ocean environment; Biological effects on navy systems and procedures; and Oceanographic engineering and instrumentation. GRA

N72-15322# SACLANT ASW Research Center, la Spezia (Italy).
SCATTERING AND REFLECTION OF UNDERWATER SOUND WAVES FROM THE SEA SURFACE. 1: AN EXPRESSION FOR THE SCATTERED FIELD
Leonard Fortuin 15 Dec. 1970 99 p refs
(AD-879641; SACLANTCEN-TR-181) Avail: NTIS CSCL 20/1

When underwater sound waves propagate from a transmitter to a receiver, part of the energy reaches the receiver after reflection from the sea surface. A generalized version of the Helmholtz integral is used to derive an expression for the corresponding transfer function, which is a random function that depends on the frequency of the incident wave, on time, and on the source-receiver configuration. For very high frequencies the formula indicates specular reflection from each surface highlight. In the Fraunhofer domain the transfer function reduces to specular reflection with phase fluctuations. A statistical analysis (mean value, frequency, time and space correlation, wave front distortion) is included for that frequency domain. The perfectly flat surface is treated as a limiting case. Quantities such as effective scattering area and Fresnel zones are analyzed to guide the random surface studies. Author

N72-15323# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
A RADIOMETER METHOD FOR DETERMINING THE THICKNESS OF SEA ICE
T. R. Hartz May 1971 14 p refs
(CRC-TN-1217) Avail: NTIS

The use of airborne radiometers to monitor emissions from sea ice at ultrahigh frequencies is considered, and, in particular, the possibility of obtaining ice thickness information by this means under certain limiting conditions is examined. It is known that radiation in the indicated frequency range can penetrate a significant distance in the ice. Consequently, for a positive thermal gradient with increasing depth, and for dielectric absorption properties that are either constant or also increasing with depth, it is shown that the observable radiation should be a characteristic function of ice thickness and of observing frequency. Observations on several frequencies can then be expected to yield an estimate of ice thickness. The expected results, the range of conditions under which the method might be applicable, and the kind of auxiliary information that might facilitate the data analysis are discussed. Author

N72-15324*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRIC FIELD VARIATIONS DURING SUBSTORMS: OGO-6 MEASUREMENTS
J. P. Heppner Jan. 1972 40 p refs Presented at the Symp. on Morphol. and Phys. of Magnetospheric Substorms, 15th IUGG Gen. Assembly, Moscow, 1971 Submitted for publication
(NASA-TM-X-65801; X-645-72-10) Avail: NTIS CSCL 04A

The OGO-6 electric field measurements make it clear that the general pattern of high latitude electric fields in magnetic time-invariant latitude coordinates is not highly variable and that when unusual variations, or field distributions, occur they are relatively isolated in time and spatial extent. Thus, electric field changes on a global scale cannot, in general, be evoked as a direct cause of substorms. Polar traverses along the 18(h) to 6(h) magnetic time meridian show that the sum of potential drops across the evening auroral belt and morning auroral belt approximately equals the potential drop across the polar cap. The integrated polar cap potential drop ranges from 20 to 100 keV and values in the center of this range are most common under conditions of moderate magnetic disturbance. Roughly near 18(h) magnetic local time, a latitudinally narrow strip at the transition between auroral belt and polar cap fields exhibits unusually large field fluctuations immediately following the sudden onset of a negative bay at later magnetic local times. It appears likely that this spatially isolated correlation is related to an effect rather than a cause of substorm enhancement. Author

N72-15325*# Techtran Corp., Glen Burnie, Md.
ALKALINE ROCKS: INDICATORS OF THE EARTH'S INTERIOR
L. S. Borodin Washington NASA Jan. 1972 27 p Transl. into ENGLISH from Priroda (Moscow), no. 5, May 1971 p 62-72 (Contract NASw-2037)
(NASA-TT-F-13782) Avail: NTIS CSCL 08G

Where do the magmatic melts originate? How do they reach the earth's surface and solidify in the form of rocks? Why are certain chemical elements concentrated in them? These and other questions of the origin of a number of alkaline rocks are discussed. These questions are difficult to answer because alkaline rocks differ from normal basalts and granites in alkaline content and the amount of rare metals. The useful mineral deposits found in these rocks are also discussed. Author

N71-15326*# Techtran Corp., Glen Burnie, Md.
SOIL MOISTURE MEASUREMENT
Gaclav Lednicky and Vaclav Richter Washington NASA Feb. 1972 11 p refs Transl. into ENGLISH from Meteorol. Zpravy (Prague), v. 22, no. 1 p 28-31
(Contract NASw-2037)
(NASA-TT-F-14137) Avail: NTIS CSCL 08M

The construction and operation of the Gallenkamp tensometer is described (2 models) and the results of soil moisture measurements taken at the Ostrava-Poruba Station are presented. The relationship between soil moisture measurements, atmospheric precipitation, and evaporation are discussed. Author

N72-15327*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE HARANG DISCONTINUITY IN AURORAL BELT IONOSPHERIC CURRENTS
J. P. Herpner Dec. 1971 32 p refs Submitted for publication
(NASA-TM-X-65799; X-645-72-1) Avail: NTIS CSCL 03B

Observations are compared to the Harang discontinuity to illustrate the reality and form of the discontinuity near midnight. High latitude magnetic disturbances and auroral displays were not found to be completely identical on any two days. The typical diurnal behavior during the night hours between 60 and 70 deg magnetic latitude was illustrated, using two patterns. Convection, time variablity, and current continuity of the Harang discontinuity are considered. J.A.M.

N72-15328# Seismological Central Observatory Graefenberg, Erlangen (West Germany).
SEISMOLOGICAL BULLETIN, 1969, OF THE SEISMOLOGICAL STATIONS OF THE FEDERAL REPUBLIC OF GERMANY
H. Aichele, comp. 1971 642 p
Avail: NTIS HC $9.00/MF $0.95

The bulletin is a compilation of data from the Hypocenter Data File of preliminary determinations of epicenters and from the Station Data File of seismogram readings. The coordinates, foundation, instrumentation, and timing system are given for each of the 16 stations. N.E.N.

N72-15329*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PROBLEM OF UNIQUENESS IN THERMOSPHERE DYNAMICS
H. Volland and H. G. Mayr Nov. 1971 23 p refs Submitted for publication
(NASA-TM-X-65791; X-621-71-467) Avail: NTIS CSCL 04A

The unique solution of tidal wave propagation within the thermosphere depends on the boundary conditions of the model. It is shown that the radiation condition leads to such a unique solution. Any other boundary values give rise to deviations from the physical solution with unrealistic physical parameters in the environment of the boundaries. The thickness of these boundary layers with unrealistic solutions is a few scale heights below the upper boundary of the model and a few tens of scale heights above the lower boundary of the model. Author

N72-15330*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REVIEW OF MAGNETIC FIELD OBSERVATIONS
Norman F. Ness Nov. 1971 19 p refs Submitted for publication
(NASA-TM-X-65790; X-690-71-465) Avail: NTIS CSCL 03B

Recent observations of magnetic fields in the magnetosphere are reviewed, and critical experiments and data are identified for theoretical analysis and interpretation. Quantitative studies of the solar wind interaction with the earth's magnetic field, regional measurements near the earth's equator at R = 2-8 R sub E, the polar cusp region of the geomagnetosphere, and structural models of the neutral sheet region in the geomagnetic tail are considered. J.A.M.

N72-15331# Norwegian Defence Research Establishment, Kjeller.
IONOSPHERIC STUDIES BY IN SITU MEASUREMENTS IN SOUNDING ROCKETS
K. Eolkestad Oct. 1970 95 p refs
(NDRE-59) Avail: NTIS

A description is given of the behavior of electrical probes in the ionosphere. Experimental results and their implications in physical terms are also discussed. The first task involves a consideration of pertinent techniques and theories for interpreting probe measurements and a treatment of phenomena and specific problems related to probing in the ionosphere. In the experimental part of the work are included several topics, such as displays of the measured distributions of electrons and ions, an examination of the height dependence of lambda, the ratio of negative ions to electrons, analysis of loss mechanisms in the D-layer, and a comparative study of experimental and theoretically derived electron temperatures. Author

N72-15332# Environmental Science Services Administration, Boulder, Colo.
QUANTITATIVE MAGNETOSPHERIC MODELS
Mar. 1970 90 p refs Symp. held at Boulder, Colo., 1970
Prepared in cooperation with Denver Univ.
Avail: NTIS

Summaries of papers presented at the conference dealing with the question of a reference magnetospheric field are presented. The intent of the meeting was to discuss the problem and to propose a magnetospheric model and corresponding computer code that can be consistently used by experimenters and theoreticians. A.L.

N72-15333 National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Data Service.
IONOSPHERIC DATA
Asheville, N. C. Natl. Climatic Center Apr. 1971 152 p refs
(NOAA-ISPDA-FA-320) Avail: SOD $1.00 as C55.218:(FA-320)

Data tables are presented giving the monthly median and other statistics for each hour of the day for the principal characteristics derived from ionograms. The graphs illustrate the diurnal variation of the medians of foF2, foF1, foE, foEs, and M(3000)F2. The data are from world-wide stations and range from January 1957 through January 1971. Author

N72-15334# Joint Publications Research Service, Washington, D.C.
MAGNETIC FLUXES IN THE TAIL OF THE MAGNETOSPHERE DURING DIFFERENT SUBSTORM PHASES
Ya. I. Feldshteyn 14 Jan. 1972 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 201, no. 1, 1971 p 82-85 Submitted for publication
(JPRS-54938; UDC-550.385.43) Avail: NTIS

The large scale structure of the geomagnetic field was studied, together with the plasma responsible for luminescence in the form of auroras in the plane of the midday-midnight meridians. Variations in the configuration of the field during disturbed periods were investigated. K.P.D.

N72-15335# Joint Publications Research Service, Washington, D.C.
NEW DATA ON THE BLACK SEA BASIN ANOMALOUS MAGNETIC FIELD
Ya. P. Malovitskiy, O. V Mikhaylov, G. V. Osipov, and B. D. Uglov 14 Jan. 1972 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 201, no. 1, 1971 p 72-74
(JPRS-54937; UDC-550.382.7(262.5)) Avail: NTIS

A magnetic field survey along the Black Sea basin was made using a sea proton magnetometer. The survey was made along a system of meridional profiles separated by a distance of 20 to 30 km. Corrections for variations were introduced using

data from Odessa and Tbilisi observations. The resulting observation accuracy (with the errors caused by introducing corrections for variation and horizontal control taken into account) was + or - 16 gamma. Author

N72-15336# Environmental Protection Agency, Rockville, Md. Office of Air Programs.
FEDERAL AIR QUALITY CONTROL REGIONS
Jan. 1972 200 p
(AP-102) Avail: SOD $1.50

The actions of the Federal Government in establishing the Clean Air Act of 1963 and subsequent 1967 amendment directing the establishment of Air Quality Control Regions are discussed. Regional programs to correct air pollution are initiated in geographical areas without regard to state boundaries. The process for establishing the Air Quality Control Regions and the responsibilities of these areas are presented. Author

N72-15337# National Oceanic and Atmospheric Administration, Rockville, Md. Environmental Research Labs.
BOMEX: PERIOD 3 HIGH-LEVEL CLOUD PHOTOGRAPHY ATLAS
May 1971 125 p
Avail: SOD $1.75 as 0317-0044

A B-57 jet aircraft flew high-level cloud photography missions during June and July 1969. Cloud pictures taken from 50,000 feet on twelve flights and from 60,000 feet on two flights are presented in composite format for the south, east, and north legs of each flight. This atlas makes available a picture inventory of midday cloud conditions over much of the BOMEX area on June 21, 22, 23, 24, 25, 26, 28, 29, 30, and July 2, 1969. Author

N72-15338# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA, OCTOBER - DECEMBER 1970
L. Liszka, ed. Dec. 1970 150 p
(Data-Summary-70/10-12) Avail: NTIS

Results of ground based continuous measurements of upper atmosphere variables carried out at Kiruna Geophysical Observatory and at the rocket range, Kiruna are presented. Author

N72-15339# European Space Research Organization, Paris (France).
WAVE-PARTICLE INTERACTIONS IN THE MAGNETOSPHERE
Aug. 1971 294 p refs Partly in ENGLISH; partly in FRENCH Proc. of a Colloq. held in Orleans, France, 17 - 19 Mar. 1971; sponsored by ESRO and CNRS
(ESRO-SP-72) Avail: NTIS

Conference papers are presented on large-scale dynamics of the magnetosphere, distribution of plasma parameters, decoupling of magnetosphere from ionospheric plasma, acceleration and convection mechanisms, substorms, and polar wind. For individual titles, see N72-15340 through N72-15362.

N72-15340# Tel-Aviv Univ. (Israel). Dept. of Environmental Sciences.
WAVE-PARTICLE INTERACTIONS IN THE MAGNETOSPHERE
Aharon Eviatar *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 6-16 refs (See N72-15339 06-13)
Avail: NTIS

The basic equations of linear and quasi-linear plasma kinetic theory are given. Some applications to observed particle phenomena in the magnetosphere are reviewed. The creation of energetic ions by magnetohydrodynamic waves is considered, and the effects of such ions on the stability of electromagnetic waves is discussed in the light of the observations made during the magnetic storm of April 18, 1965. Electrostatic ion waves are reviewed. The state of knowledge of electron-wave interaction is surveyed. Various models involving whistlers, electrostatic modes, and electromagnetic radiation normal to the field lines are discussed as means of explaining the observed particle lifetimes diffusion processes and the local acceleration phenomena. Author (ESRO)

N72-15341# Imperial Coll. of Science and Technology, London (England).
A THEORY OF VLF EMISSIONS c07
D. Nunn *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 17-33 refs (See N72-15339 06-13)
Avail: NTIS

Resonant particle trajectories in a narrow band whistler wave in an inhomogeneous medium are studied. It is found that second order resonant particles become stably trapped in the wave. After one or two trapping periods, these particles can make a dominant contribution to the resonant particle current. A realistic zero order distribution function is selected, involving a source of potential energy in the loss cone form. The resonant particle currents are computed for the case of a constant amplitude whistler crossing the magnetospheric equator. The results tend to explain many of the features of triggering. The equations governing the time development of the wave field due to the presence of a resonant particle current are developed. Resonant particle currents are computed for various generation region type field configurations. Author (ESRO)

N72-15342# Groupe de Recherches Ionospheriques, Paris (France).
QUASI LINEAR CALCULATION OF VLF HISS SPECTRUM c07
J. Etcheto, A. Roux, R. P. Singh, and J. Solomon *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 37-40 refs (See N72-15339 06-13)
Avail: NTIS

It is assumed that emission of VLF waves is the result of a cyclotron interaction of energetic electrons with the whistler mode. If the wave frequencies are much smaller than the electron gyrofrequency, energy diffusion for the particles can be neglected. In this case, the distribution function of the energetic electrons and the wave magnetic field have to satisfy the coupled equations of pitch-angle diffusion and wave energy conservation. The steady state case is considered together with the assumption that a given anisotropic source of particles maintains a constant anisotropic distribution function of energetic electrons. The inhomogeneity of the medium is taken into account and the equilibrium spectrum of the waves for different values of the anisotropy and of the mean velocity of the energetic electrons of the source is calculated. This case is applicable to continuous emissions of low level VLF hiss associated with continuous electron precipitation. The spectra which are obtained are similar to the ones measured by OGO 3 and Ariel 3. Author (ESRO)

N72-15343# European Space Research and Technology Center, Noordwijk (Netherlands).
RECENT WORK ON ION-CYCLOTRON WHISTLERS c07
Dyfrig Jones *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 43-62 refs (See N72-15339 06-13)
Avail: NTIS

Experimental and associated theoretical research is concentrated on the mechanisms that affect electromagnetic waves propagating in the upper ionosphere at local ion gyrofrequencies. It is found that both polarization reversal and mode-coupling manifest themselves in the phenomena observed in this VLF range by satellite receivers. In addition, reflection of the ion cyclotron mode at an altitude which is dependent on frequency is also important in waves propagating downwards into the ionsophere. Author (ESRO)

N72-15344# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
WAVE-PARTICLE INTERACTION IN THE PLASMASPHERE
G. Haerendel *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 63-77 refs (See N72-15339 06-13)
Avail: NTIS

Gyroresonant, wave particle interactions in the magnetosphere are discussed. Protons in the energy range of some tens of keV outside the plasmasphere are less efficiently transported into the plasmasphere than for the higher energies. During the sudden transition of several hundred keV protons through the plasmapause, ion cyclotron waves may be generated with substantial amplitudes. Pearl-type micropulsations were related to this process. Electrons at a few tens of keV inside the plasmasphere appear to be at the stable trapping limit, and to generate ELF hiss observed in the plasmasphere. Two hypotheses for the origin of a slot in the electron distribution at higher energies are discussed. ESRO

N72-15345# European Space Research Inst., Frascati (Italy).
ON THE STRUCTURE OF THE GEOMAGNETIC TAIL c29
Karl Schindler *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 81-82 refs (See N72-15339 06-13)
Avail: NTIS

The role of the plasma sheet in geomagnetic tail models is discussed. A model is considered in which the dominant contributions to the momentum balance of a volume element inside the plasma sheet are the gradient of a scalar pressure balancing the stresses exerted by the magnetic field, for field lines which are pulled-out dipole lines. A model which allows for the presence of closed loops analyzed with data from Explorer 34 satellite, and showed consistency for loops imbedded in the neutral sheet. A model allowing for neutral point instabilities and particle acceleration was shown to require more experimental work, as several problems concerning the plasma sheet arose. ESRO

N72-15346# European Space Research Inst., Frascati (Italy).
A NONLINEAR THEORY OF TYPE 1 IRREGULARITIES IN THE EQUATORIAL ELECTROJET
Andre Rogister *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 83-92 refs (See N72-15339 06-13)
Avail: NTIS

The nonlinear development of the Farley-Buneman magnetohydrodynamic instability in the equatorial electrojet is discussed. The stabilization mechanism is as follows: a turbulent (negative) vertical electron flux develops in the turbulent layer. In order to preserve charge neutrality, the (positive) vertical ion flux decreases accordingly. Hence the secondary magnetic field, and the electrojet current also decreases, thereby quenching the instability. The predictions of the theory are shown to agree quite well with the experimental evidence available. ESRO

N72-15347*# Minnesota Univ., Minneapolis. School of Physics.
WAVES GENERATED BY A CONTROLLED BEAM OF ELECTRONS ARTIFICIALLY INJECTED INTO THE IONOSPHERE: THE ELECTRON ECHO EXPERIMENT
D. G. Cartwright and P. J. Kellogg *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 95-107 refs (See N72-15339 06-13)
(Grant NGL-24-005-008)
(NASA-CR-125315) Avail: NTIS CSCL 04A

The Electron Echo experiment injected about 3000 pulses of energetic electrons into the ionosphere at pitch angles between 65 and 115 deg from an Aerobee 350 sounding rocket. The pulses were 16 msec long, spaced 1/10 sec apart; the beam current was 70 mA, and the electron energy varied between 35 and 45 keV. The observations in the frequency range 16 Hz to 10 MHz of the electric wave component are presented. Wave generation by the beam electrons was observed at frequencies near the plasma frequency and the upper hybrid resonance frequency of the ambient ionospheric electrons, at frequencies below the electron cyclotron frequency, and at frequencies near twice the electron cyclotron frequency. These waves have phase velocities low enough to interact strongly with the emitting particles. Author (ESRO)

N72-15348# Sheffield Univ. (England). Dept. of Physics.
STUDIES OF VLF EMISSIONS IN THE SATELLITE ARIEL 3 c07
T. R. Kaiser *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 109-121 refs (See N72-15339 06-13)
Avail: NTIS

Ariel 3 was a near-earth satellite (altitude 500-600 km) with a high-inclination orbit. Tape recorder storage provided almost continuous data over a period of 10 months at all magnetic latitudes and local times. The VLF emissions were observed primarily in two regions at high invariant latitudes (70 to 80 deg lambda) and at medium latitudes (50 to 60 deg lambda). Medium-latitude emissions are generated close to the equatorial plane by the transverse resonance instability and have a strong storm-time dependence. They also exhibit a marked longitudinal structure which co-rotates with the earth. High-latitude emissions are an auroral-oval type with pronounced maxima at 23 and 14 h MLT. These are attributed, respectively, to precipitation of soft electrons from the magnetospheric tail and from the cusps on the solar side. Author (ESRO)

N72-15349# Groupe de Recherches Ionospheriques, Paris (France).
EXPERIMENTAL STUDY OF ELECTRON PITCH ANGLE DIFFUSION IN THE PRESENCE OF VLF MODULATED HISS
J. Etcheto, R. Gendrin, and D. Lemaire *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 123-133 refs (See N72-15339 06-13)
Avail: NTIS

Results obtained during a rocket sounding, in which particles and VLF waves were measured simultaneously, are presented. The VLF modulated hiss was present during the flight. The electron precipitation was observed to increase at the same time as the amplitude of the VLF waves. The distribution function of the electrons in the vicinity of the loss cone was partially measured. The anisotropy was observed to decrease when the VLF field increased. From this anisotropy measurement, the diffusion coefficient was deduced at the maxima and minima of the modulation. The ULF wave observations can be placed in the framework of Coroniti and Kennel's theoretical work, concerning weak and near-strong diffusions. Author (ESRO)

N72-15350# Groupe de Recherches Ionospheriques, Paris (France).
CORRELATION BETWEEN VLF EMISSION FLUX AND ELECTRON PITCH ANGLE DISTRIBUTION AS DEDUCED FROM A ROCKET FLIGHT IN THE AURORAL ZONE
M. Hamelin *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 139-144 refs Sponsored by CNES (See N72-15339 06-13)
Avail: NTIS

Preliminary results are presented from a rocket experiment launched in the auroral zone with a VLF receiver and energetic electron detectors onboard. These detectors were aimed roughly in the direction of spin axis and perpendicularly to this axis. The energy detected was divided into several channels between 10 and 300 keV. A VLF emission, auroral chorus, was detected between 400 and 1000 Hz during two separate periods. The data show a strong enhancement of precipitated and trapped electron fluxes occurring during the chorus event. These events are associated with an increase of amplitude of the PC 3 - 4 magnetic disturbances detected on the ground. Author (ESRO)

N72-15351# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
PROBLEMS RELATED TO HIGH-LATITUDE ELECTRIC FIELDS AND CURRENTS
C. G. Faelthammar and L. P. Block *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 147-156 refs (See N72-15339 06-13)
Avail: NTIS

Various experiments and coordinated studies are proposed to help clarify the complicated electrodynamics of the low-density plasma above the ionosphere. The response of this plasma to electric fields has a direct bearing on the electrical and dynamical coupling between the magnetosphere and the ionosphere. Based on observations from a noneccentric polar-orbiting satellite, the response of the magnetospheric plasma to electric fields, and problems related to field-aligned currents, are discussed. ESRO

N72-15352# Sheffield Univ. (England). Dept. of Physics.
MAGNETOSPHERIC STRUCTURE DEDUCED FROM WHISTLER OBSERVATIONS AT HALLEY BAY c07
J. L. Sagredo and K. Bullough *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 157-161 refs (See N72-15339 06-13)
Avail: NTIS

Whistlers were observed at Halley Bay (33.4 deg E; 75.5 deg S; 60.7 deg invariant latitude) on July 26, 1967 extending through the period 0509 to 2305 U.T. Whistlers were found to have exit points situated along a strip about 100 km wide, passing through Halley Bay in an azimuthal direction 30 deg E of N between 57 and 62 deg invariant latitude. It is suggested that the magnetospheric structure was initiated by proton precipitation along the solar zenith angle 102 deg contour.
Author (ESRO)

N72-15353# Southampton Univ. (England). Dept. of Physics.
DAWN-DUSK ELECTRIC FIELDS ACROSS THE MAGNETOSPHERE DERIVED FROM PLASMAPAUSE OBSERVATIONS
M. J Rycroft *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 163-173 refs (See N72-15339 06-13)
Avail: NTIS

Whistler observations of the plasmapause position were analyzed statistically. The inward motion of the plasmapause, associated with increased magnetic activity and with increasing local time during the night, is interpreted quantitatively. It is shown that the average dawn-dusk electric field across the tail of the magnetosphere, due to the interaction of the solar wind with the geomagnetic field, increases linearly. Author (ESRO)

N72-15354# Sussex Univ., Brighton (England). School of Mathematical and Physical Sciences.
GYRORESONANT WAVE-PARTICLE INTERACTIONS IN A SPATIALLY VARYING MAGNETIC FIELD AND PLASMA DENSITY
J. Troughton and G. Martelli *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 175-186 refs (See N72-15339 06-13)
Avail: NTIS

Solutions are considered for linearized nonrelativistic equations of motion of an electron field of a right hand, circular polarized, electromagnetic wave propagating parallel to a magnetic field. The magnetic field and plasma density are assumed to vary in space along the direction of propagation. The gyroresonance condition for the wave particle interaction is satisfied only at one point in space. Exact particle trajectories are compared with linear equation solutions; the latter gave a good representation of the motion as long as the initial pitch angle of the particle is smaller than 10 deg, and the magnetic field and plasma density show a spatial variation greater than a minimum variation. When these conditions are satisfied, the linear equations yield simple expressions for pitch angle change of the particle. These results are used to illustrate pitch angle scattering of electrons interacting with VLF radiation in the earth's magnetosphere. Author (ESRO)

N72-15355# Sussex Univ., Brighton (England). School of Mathematical and Physical Sciences.
WAVE AND BEAM LABORATORY EXPERIMENTS IN A MAGNETO-ACTIVE PLASMA
P. J. Christiansen, C. Christopoulos, and G. Martelli *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 187-195 refs Sponsored jointly by Sci. Res. Council and UKAEA (See N72-15339 06-13)
Avail: NTIS

Experiments are described which examine: (1) the nonlinear interaction of fast electron beams with whistler (helicon waves) at the Doppler shifted cyclotron frequency; the results are compared with some theoretical predictions; (2) the natural noise spectra near the electron cyclotron frequency of an RF excited plasma; and (3) the propagation of Bernstein waves at ambient plasma densities. Author (ESRO)

N72-15356# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
PARALLEL ELECTRIC FIELD, NEAR THE AURORAL IONOSPHERE, DEDUCED FROM ENERGY SPECTRA, ANGULAR DISTRIBUTIONS AND TIME VARIATIONS OF LOW ENERGY AURORAL ELECTRONS AND PROTONS
H. Reme and J. M. Bosqued *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 197-213 refs (See N72-15339 06-13)
Avail: NTIS

Auroral observations from a French Dragon rocket experiment are reported for 5-30 keV electron flux variations and small pitch angle 0.5-5 keV proton flux variations. Energy spectra, angular distributions, and time variations of the particles are interpreted along the geomagnetic field lines, for about 115 seconds of a 1 to 2 kV potential difference. The electric field source is plasma turbulence, linked to 5-30 keV electron precipitation, making the parallel resistance increase due to ion cyclotron waves.
Author (ESRO)

N72-15357# European Space Research and Technology Center, Noordwijk (Netherlands).
ONBOARD COMPUTERS FOR SATELLITES c08
Durney and Fokine *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 215-229 ref (See N72-15339 06-13)
Avail: NTIS

The problems of onboard computers are analyzed, emphasizing data suppression, reliability, and availability. For a simple particle experiment, a comparison is made between the coupling to a conventional telemetry system and the interface with an onboard computer. The flexibility of the latter system is shown, and a flow diagram is used to illustrate the degree of experimental control. The difficulties of organizing a spacecraft program which includes an onboard computer are discussed, and some suggestions are made for easing design problems.
Author (ESRO)

N72-15358# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
THE PHYSICS OF THE CHANNEL ELECTRON MULTIPLIER c14
C. Barat *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 231-239 refs (See N72-15339 06-13)
Avail: NTIS

A windowless tubular electron multiplier for the detection of low-energy charged particles is described, capable of detecting 50 eV electrons and 300 eV protons. The detector characteristics of gain, efficiency, and resolution are given. Its lifetime in terms of gain variation, as a function of the number of accumulated counts, is shown to have good characteristics between 5 times 10 to the 7th power and 10 to the 10th power of counts. Temperature dependence is briefly discussed. ESRO

N72-15359# Groupe de Recherches Ionospheriques, Paris (France).
FAST ANALYSIS OF PITCH ANGLE AND ENERGY DISTRIBUTION OF ENERGETIC PROTONS c14
J. Etcheto and B. de la Porte des Vaux *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 241-248 refs (See N72-15339 06-13)
Avail: NTIS

A method of simultaneously measuring proton pitch angle and energy distribution is described. A position sensitive solid state detector, based on a silicon-silver surface barrier, was used to determine the angle of arrival of the protons with respect to its axis. The device was able to measure energy and incident angle of 10,000 particles per second. Two methods of application, depending on the telemetry bandwidth available, are presented. The device can measure the pitch angle distribution of medium energy protons quickly and precisely. Applications to the study of wave-particle interactions are suggested. ESRO

N72-15360# Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
THE STUDY OF PLASMA RESONANCES WITH A SINGLE ANTENNA c25
Michel Petit *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 249-257 refs (See N72-15339 06-13)
Avail: NTIS

The plasma resonance detection with a single dipole antenna and the possible application to reliable measurements of electron density and electron gyrofrequency are reported. The phenomenon was observed with ionosondes, where for particular frequencies, the receiver recorded a long ringing signal, lasting for several milliseconds after pulse transmission. The frequencies at which this phenomenon occurs are fixed by resonances of local plasma, rather than by reflections. An integrated wave experiment is proposed, which can serve as a tool for the study of natural waves and as a diagnostic device for plasmas by means of their resonances. ESRO

N72-15361# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
MAGNETOSPHERIC STUDIES AT 10 EARTH RADII
G. P. Haskell *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 261-263 (See N72-15339 06-13)
Avail: NTIS

Substorms are studied triggered by solar wind changes or by an internal instability of the magnetosphere. The region of space near 10 R sub E in the equatorial plane is suggested as suitable for experimental study. Satellite orbits with apogees close to 10 R sub E are recommended for these magnetospheric investigations. Author (ESRO)

N72-15362# Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
STUDY OF THE INTERACTIONS IN THE MAGNETOSPHERE AND THE PROGRAM OF ESRO [L'ETUDE DES INTERACTIONS DANS LA MAGNETOSPHERE ET LE PROGRAMME DE L'ESRO]
F. duCastel *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 265-267 In FRENCH (See N72-15339 06-13)
Avail: NTIS

The orbits, experiments, configurations, launchers, and satellites, for the study of magnetospheric wave-particle interactions in the framework of the ESRO program, are discussed. ESRO

N72-15363# SACLANT ASW Research Center, la Spezia (Italy).
A HIGH DENSITY DIGITAL RECORDING SYSTEM FOR UNDERWATER SOUND STUDIES
Alessandro Barbagelata, Alain Castanet, Robert Laval, and Mario Pazzini 15 Jul. 1970 58 p refs
(AD-874703; SACLANTCEN-TR-170) Avail: NTIS CSCL 20/1

A high-density digital recording system is described that allows the conversion from analogue to digital form of up to twenty input analogue channels, their recording on magnetic tape, their readback from tape, and their transfer to a digital computer. The heart of the system is a standard 14-track analogue instrumentation tape-recorder, of the wide-band type, working in direct-recording mode at a speed of 30 in./sec and used for digital recording at a density of about 12 kilobits per inch and per track. A total data recording rate of 2880 kilobits per second is achieved with ten magnetic tracks. The system has been successfully tested during various sea trials and is now fully operational. Author

N72-15364# National Ocean Survey, Rockville, Md.
EXPLOSION EFFECTS AND EARTHQUAKES IN THE AMCHITKA ISLAND REGION
E. R. Engdahl 29 Jun. 1971 20 p refs
(Contract AT(29-2)-746)
(CGS-746-120) Avail: NTIS

Microearthquake monitoring by a network of seismographs located on Amchitka and nearby islands reveals that the nature of earthquake activity in this region is consistent with the hypothesis of underthrusting of the Aleutian arc by a rigid lithospheric plate. Observable effects of the Milrow nuclear explosion were small, of short duration, confined to the region immediate to the explosion, and were apparently independent of this geotectonic mechanism. Author (NSA)

N72-15365# Toulouse Univ. (France).
RADON AND AEROSOL DIFFUSION IN THE TROPOSPHERE Ph.D. Thesis
Andre Birot 1971 169 p refs In FRENCH
(FRNC-TH-40) Avail: AEC Depository Libraries

The purpose of this work is to show the interest of a natural radioactive gas, the radon, in physics of the atmosphere, especially for studying the tropospheric exchanges. This study is conducted under two different and complementary ways: A theoretical work on models based upon a numerical solution of the classical diffusion equation, and experimental work in situ. The models are presented under different conditions: geometry of the source, diffusivity profile and vertical wind profile, etc. The experimental results, interpreted by the numerical models and the meteorological analysis, show the radon component as tracer. Author

N72-15366# Bergen Univ. (Norway). Dept. of Physics.
A SOUNDING ROCKET EXPERIMENT FOR MEASURING ENERGETIC CHARGED PARTICLES
H. R. Lindalen, F. Soeraas, and K. Aarsnes Mar. 1971 20 p refs
(NP-18976; Rept-33) Avail: AEC Depository Libraries

Since 1962 a number of rockets have been launched from the Norwegian rocket range at Andoya. (69.4 N, 16.1 E.) These rockets have been instrumented by different scientific groups interested in the physics of the upper atmosphere and the magnetosphere, and have carried aloft payloads capable of measuring simultaneously a number of parameters pertinent to the understanding of the physical processes involved. As a part of an integrated payload, the Department of Physics, University of Bergen, has flown a solid state charged particle spectrometer in order to measure the fluxes and energy spectra of electrons in the energy range 30 to 300 keV, and of protons in the energy range 100 keV to 5 MeV. It is the purpose of this note to report on techniques employed in the charged-particle experiment and to describe the electronic circuitry involved. NSA

N72-15367# Bergen Univ. (Norway). Dept. of Physics.
VARIATIONS IN THE HIGH LATITUDE PROTON TRAPPING BOUNDARY ASSOCIATED WITH POLAR MAGNETIC SUBSTORMS

H. R. Lindalen, F. Soeraas, K. Aarsenes, and R. Amundsen Jan. 1971 29 p refs
(NP-18977; Rept-31) Avail: AEC Depository Libraries

Protons in the energy range (100 to 200) keV in the noon-midnight meridian plane were studied from the data obtained by the ESRO 1A satellite. From this study it is observed that, during quiet geomagnetic conditions, there is a single zone of precipitating protons located at an invariant latitude of 67 deg on the nightside and two zones located at invariant latitudes of 70 and 77 deg on the dayside. Closely correlated with the polar magnetic substorm, the proton trapping boundary moves poleward, the two zones of proton precipitation on the dayside merge into one zone, and the energy input into the atmosphere increases. Preceding the poleward movement of the trapping boundary, there is an intensity increase in the already existing proton precipitation on the nightside. NSA

N72-15368# Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
ATMOSPHERIC DILUTION FACTORS AND CALCULATION OF DOSES IN THE ENVIRONMENT OF SCK/CEN MOL FOR SHORT AND LONG DURATION STACK DISCHARGES, VOLUME 1
H. Bultynck, L. Malet, L. N. Sharma, and J. VanderParren Jun. 1970 90 p refs
(BLG-446-Vol-1) Avail: AEC Depository Libraries

The knowledge acquired in the field of atmospheric diffusion from the study of turbulent diffusion of effluents from a high continuous source in relation to atmospheric stability was applied to nuclear discharges at Mol, Belgium. Seven categories of stability were adopted; a separate approach is proposed for the case of fumigation. Loss of material in the plumes due to settling, dry deposition, and washout by rain was considered, applying appropriate correction factors. A mathematical model was developed to treat the problem of contamination of the atmosphere and surface in the case of long duration releases. Polar diagrams are presented for integrated concentrations in the air and average deposition on the ground. Calculations of doses following a radioactive release into the atmosphere were made, taking into account the possible paths of exposure. Diagrams for the determination of dilution factors are given. Author (NSA)

N72-15369# Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
ATMOSPHERIC DILUTION FACTORS AND CALCULATION OF DOSES IN THE ENVIRONMENT OF SCK/CEN MOL FOR SHORT AND LONG DURATION STACK DISCHARGES, VOLUME 2
H. Bultynck, L. Malet, L. N. Sharma, and J. VanderParren [1970] 113 p
(BLG-446-Vol-2) Avail: AEC Depository Libraries

Data tabulations are presented for atmospheric dilution factors and calculations of doses in the SCK/CEN Mol environment for short and long duration stack discharges. NSA

N72-15370# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
NORTH-SOUTH ASYMMETRY IN POLAR CAP REGIONS
V. Bomingo and D. E. Page [1971] 21 p refs Submitted for publication
Avail: NTIS

An experiment on the ESRO 1/Aurorae satellite recorded on 24 January 1969 a flux over the central north pole which at times was a factor of 7 greater than that seen over the south pole. This asymmetry is discussed in relation to the interplanetary field direction measured at the same time by the HEOS spacecraft and comparison is made with the 2 November 1967 opposite asymmetrical configuration as observed by Evans and Stone (1969). From the evidence of two events it would appear that field connexion associated with a southward interplanetary field plays a significant role and that the polar asymmetry is probably further enhanced by anisotropic particle arrival. It is noted, without any conclusions being drawn, that the solar flare giving rise to the north pole excess was at 20 N, 09 W while that for the south pole excess was at 18 S, 02 W. Author (ESRO)

N72-15371# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
DIURNAL, SEASONAL AND Kp VARIATIONS IN THE POSITION OF THE HIGH LATITUDE ELECTRON TRAPPING BOUNDARY
D. E. Page and M. L. Shaw 1971 16 p refs Presented at the COSPAR meeting, Seattle, Jun. 1971
(Paper-I-4) Avail: NTIS

Data acquired from the ESRO 1/Aurorae polar satellite has been used to determine the variation of latitude of the northern high latitude electron trapping boundary over a period of about 15 months. The position of the boundary has been determined for about four thousand crossings, and an attempt has been made to determine the significance of any seasonal variations in the position of the boundary. The diurnal variation of the boundary position is shown to be well established. A significant variation with the level of geomagnetic activity has been observed indicating that with increasing Kp the boundary moves to higher latitudes during the morning hours and to lower latitudes during the evening. The degree of boundary movement is compared with changes in solar wind velocity and shape of the magnetosphere and the sense of the movement is shown to be in agreement with magnetic field measurements made at the earth. There would appear to be a seasonal variation, with the trapping boundary shifting to higher latitudes at the equinoxes. Author (ESRO)

N72-15372# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
ATMOSPHERIC LIGHT TRANSMISSIVITY AND SCATTERING IN THE VISIBLE SPECTRUM AND IN WINDOWS OF THE INFRARED REGION UP TO 5 MICROMETERS. STATE-OF-THE-ART, MEASURING INSTRUMENTS, MEASUREMENTS. [ATMOSPHAERISCHE LICHTDURCHLAESSIGKEIT UND STREUUNG IM SICHTBAREN SPEKTRALBEREICH UND IN DEN FENSTERN DES IR-BEREICHES BIS ZU 5 MICROMETERN. STAND DES WISSENS, MESSGERAETE, MESSUNGEN]
G. H. Ruppersberg, H. VonRedwitz, and R. Schellhase Bonn Bundeswehramt 1971 89 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-71-16) Avail: NTIS; Bundeswehramt: 25 DM

An outline on atmospheric transmissivity and atmospheric scattering of light is given, excluding the region of the absorption bands. Some relations between optical and physico-chemical properties of the atmosphere are discussed. Measurements were made with an AEG-scattered light recorder in the visible and the near infrared region up to very large standard visual ranges. Some results of the Atlantic Expedition 1965 (GARP) are presented. A Multiple Infrared Scattered Light Recorder (MIRST) was developed, which measures visibility simultaneously on three different wavelengths up to 3.55/micro mebes. This instrument is under test. Author (ESRO)

N72-15373# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
FEASIBILITY STUDY OF A MODEL EXPERIMENT FOR THE EQUATORIAL ELECTROJET
B. Buti and L. Lindberg Sep. 1971 19 p refs
(TRITA-EPP-71-21) Avail: NTIS

The possibility of a model experiment for the simulation of the equatorial electrojet in the laboratory is discussed. The experiment would simulate the electric field, the magnetic field, and the gas density gradient perpendicular to one another. Possibilities for gas ionization were investigated, and an apparatus in a metal vessel is proposed. A theoretical evaluation showed that it is feasible to simulate the electrojet. ESRO

N72-15374# Kiruna Geophysical Observatory (Sweden).
ON THE RELATION BETWEEN THE AURORAL PARTICLE PRECIPITATION AND THE IONOSPHERIC TROUGH
Ludwik Liszka and Tauno Turunen Sep. 1971 23 p refs Sponsored jointly by Swed. Natl. Council of Nat. Sci. and Finn. Natl. Res. Council of Sci.
(KGO-Preprint-71-306) Avail: NTIS

A comparison between the low energy electron measurements (1 keV) from the ESRO-1A satellite and ionospheric conditions recorded at three Scandinavian ionosondes during the evening and midnight sectors, indicates that the ionospheric trough is located at the southern boundary of the precipitation region. The trough is ascribed to the effects of local neutral winds generated by low energy particle heating in the auroral zone, and possible mechanisms are discussed. Author (ESRO)

N72-15375# Kiruna Geophysical Observatory (Sweden).
POLARIMETER OBSERVATIONS OF THE INTELSAT 2F-1 SATELLITE AT SUBAURORAL LATITUDES
Sixten Olsson and Ludwik Liszka Aug. 1971 30 p refs Presented at the Joint Satellite Studies Group meeting, Florence, 4-9 Oct. 1971 Sponsored by Swed. Natl. Council of Nat. Sci.
(KGO-71-712) Avail: NTIS

During the period July to September 1970 polarimeter recordings from two widely spaced stations were used to study the changes in the mean daytime ionosphere. During moderate magnetic activity, typical values for total electron content of 15 to 20 x 10 to the 12th power per sq cm and slab thickness of 200 to 400 km were found. Repeated geomagnetic storms during parts of the period were the cause of rather complicated behavior of the ionosphere. One major magnetic storm in August offered possiblities for comparison of the effects recorded with investigations made at sunspot minimum of a storm in June 1965. The results were found to be similar. The duration of satellite signal reception was also studied and compared with the calculated time of the satellite above the horizon. On three different occasions, two of which coincided with heavy magnetic activity, satellite signal reception occurred several hours after the satellite set under the horizon. It was found that during the summer period the signal never appeared before the expected time. A suggested explanation is ducting in the upper ionosphere. Author (ESRO)

N72-15376# European Space Research Inst., Frascati (Italy).
THE REFLECTION AND AMPLIFICATION OF ACOUSTIC-GRAVITY WAVES AT A DENSITY AND VELOCITY DISCONTINUITY
James F. McKenzie 1971 32 p refs Submitted for publication
Avail: NTIS

The reflection and refraction of a plane acoustic-gravity wave at an interface separating two fluids in relative motion is calculated. It is found, as in the case of purely acoustic waves, that the reflection coefficient for gravity waves can exceed unity (that is to say the reflected wave can be amplified) if the relative flow speed exceeds the horizontal phase speed of the incident gravity wave: This result, which implies that gravity waves extract energy and momentum from the mean flow, is discussed along with the idea of a critical layer at which the energy and momentum of gravity waves are absorbed into the mean flow. On the basis of the present analysis it is suggested that very low frequency gravity waves may decay, via a resonant three-waves interaction, into higher frequency gravity waves. Author

N72-15377# Danish Meteorological Inst., Charlottenlund.
RECOMMENDATION OF PREFERRED SI-UNITS IN GEOPHYSICS
F. Primdahl 1971 22 p refs
(R-24) Avail: NTIS

A set of preferred SI units in geophysics is recommended for adoption by the IAGA. The units are chosen from the existing MKSA units and have integral power-of-ten conversion factors to the absolute electromagnetic system. The units currently used in geophysics thus become legal subunits of the prefered SI units. The use of preferred SI units is demonstrated in the treatment of magnetic materials. A list of general equations related to geophysics and independent of units systems is given, together with indications on how to convert them to preferred SI units or to any other unit system. Author (ESRO)

N72-15378# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
ON THE ASTROMETRIC REDUCTION OF SATELLITE PHOTOGRAPHS AND THE APPLICATION TO GEOS-2 PLATES [UEBER DIE ASTROMETRISCHE AUSWERTUNG PHOTOGRAPHISCHER SATELLITENAUFNAHMEN UND IHRE ANWENDUNG AUF GEOS-2-PLATTEN]
Holger Schnuerer Jan. 1971 54 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-28) Avail: NTIS; DFVLR Porz: 12,75 DM

The evaluation of satellite photographs with the astrometric method is described. The measurement of photographic plates on the comparator and the reduction of measured satellite and star coordinates are discussed. The reduction of star catalog values, the determination of satellite directions, and the reduction of observation times are described. The interrelation of different parts of the computing process is elucidated by means of a block diagram. The method is, by way of example, applied to two GEOS-2 plates. The accuracy with which the directions can be determined is estimated from the known geocentric coordinates of satellite and the satellite directions as measured.
Author (ESRO)

N72-15379# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).
DETAILED AEROLOGICAL TABLES OF OZONE MEASUREMENTS COMPARISONS FROM 19 JANUARY TO 6 FEBRUARY 1970 [AUSFUEHRLICHE AEROLOGISCHE TABELLEN DES OZONSONDENVERGLEICHS VOM 19.1. - 6.2 1970]
Jun. 1971 216 p In GERMAN *Its* Sonderbeobachtungen des Meteorol. Obs. Hohenpeissenberg Nr. 14
Avail: NTIS

Ozone sondes in 41 tandem balloon ascents were compared under normal ascent conditions. Types of sonde were Brewer Mast sonde, Komhyr electrochemical concentration cell, KC-68 sonde, and Brewer sondes type Indian, Italian, and DDR. The complete ozone and ascent tables are given for each successful sounding. ESRO

N72-15380# Meteorologisches Observatorium, Hohenpeissenberg (West Germany).
RESULTS OF AEROLOGICAL OZONE SOUNDINGS AND TOTAL OZONE MEASUREMENTS DURING THE FIRST HALF OF 1971 [ERGEBNISSE DER AEROLOGISCHEN OZONSONDIERUNGEN UND DER GESAMTOZONMESSUNGEN IM 1. HALBJAHR 1971]
Aug. 1971 159 p In GERMAN *Its* Sonderbeobachtungen des Meteorol. Obs. Hohenpeissenberg Nr. 15
Avail: NTIS

In the framework of the European ozone sounding network, ozone soundings were made from the Hohenpeissenberg Observatory during the first half of 1971, using Brewer-Mast ozone sondes and the Dobson ozone spectrophotometer No. 104. The results are given as ozonograms and tables. ESRO

N72-15381# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERE AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Jan. 1971 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, JANVIER 1971]
1971 31 p In DUTCH and FRENCH
Avail: NTIS

Ionospheric and cosmic ray (neutron component) observations at Dourbes (Belgium) are tabulated for January 1971. ESRO

N72-15382# Bochum Univ. (West Germany). Abteilung fuer Physik und Astronomie.
TABLES OF MIE-SCATTERING FUNCTIONS. PART 1: MIXTURES OF DIELECTRIC PARTICLES
Richard Heinrich Giese Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. May 1971 133 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-71-23; DK-535.36; DK-681.3.06) Avail: NTIS; ZLDI Munich: 27,80 DM

A program for computing light scattering functions of dielectric and absorbing spheres (Mie-theory) is described. Average scattering functions of polydisperse mixtures of dielectric particles with refraction indexes of 1.33, 1.5, and 1.7, are presented for different size distributions in the ranges of the size parameter circumference/wavelength between 1 to 10, 10 to 60, and 120. The accuracy of single particle scattering functions is compared with other authors and attention is drawn to the necessity to compute polydisperse mixtures by very small steps of the size parameter to be used in the numerical integration. ESRO

N72-15383*# Dartmouth Coll., Hanover, N.H. Dept. of Geography.
COLOR INFRARED (CIR) PHOTOGRAPHY: A TOOL FOR ENVIRONMENTAL ANALYSIS
David T. Lindgren Aug. 1971 42 p refs Prepared for Geol. Surv., Washington, D. C.
(NASA Order W-13318; Contract DI-14-08-0001-129-58; Task-160-75-71-03)
(NASA-CR-125288; PB-204472; IR-USGS-219) Avail: NTIS In color MF only. This document is not available from the NASA Scientific and Technical Information Facility, College Park, Md. CSCL 08F

Research carried out under NASA auspices suggests that in the future remote sensors may play an important role in monitoring our environment. One medium, color infrared photography, appears to have immediate utility. Its capability to identify, measure the acreage of, and monitor the health of agricultural and woodland resources has been demonstrated, as has its capability to identify the sources and extent of certain types of water pollution. CIR is also beginning to demonstrate considerable potential as a tool for urban analysis. The great value of CIR is that it can provide these data quickly and inexpensively, and for that reason will be preferred to more complex multispectral systems by budget-conscious administrators. Author

N72-15384# California Univ., Los Angeles. Plasma Physics Group.
MAGNETOPAUSE MOTIONS, DP-2, AND THE GROWTH PHASE OF MAGNETOSPHERIC SUBSTORMS
F. V. Coroniti and C. F. Kennel Sep. 1971 32 p refs
(Contract N00014-69-A-0200-4023; NR Proj. 012-306)
(AD-731058; PPG-99) Avail: NTIS CSCL 04/1

A southward shift of the solar wind magnetic field enhances field-cutting at the dayside magnetopause and internal magnetospheric convection. The magnetopause is connected to highly conducting dayside auroral oval ionosphere where large Pederson currents flow in response to convection electric fields. When field-cutting starts, internal magnetic flux cannot return freely to the magnetopause, but flows at a line-tied limited rate determined by the ionospheric conductivity. If the line-tied flux return rate is less than the field-cutting rate, the magnetopause shrinks in size. The distorted magnetopause forces more current into the ionospheric Pederson circuit, which then self-consistently permits a larger flux return rate. For typical magnetospheric parameters, the time constant for the establishment of equal flux return and field cutting rates is 20-40 minutes; the magnetopause shrinkage is 1-2 R sub E; the missing flux adds roughly 10% to the geomagnetic tail flux. The time constant for convection establishment is consistent with DP-2 and the growth phase of magnetospheric substorms. Author (GRA)

N72-15385# Michigan Univ., Ann Arbor. William Run Labs.
MULTISPECTRAL RADIATIVE CHARACTERISITCS OF ARCTIC SEA ICE AND TUNDRA Final Report
Robert Horvath and William L. Brown Jul. 1971 78 p refs
(Contract Nonr-426(00))
(AD-731070; Rept-027980-2-F) Avail: NTIS CSCL 08/12

Multispectral remote sensor data acquired from an aircraft in the vicinity of Barrow, Alaska are analyzed and the results of the analysis are presented. The spectral, spatial, and temporal radiation characteristics measured directly by the calibrated sensors for a variety of targets are compared and discussed. These data are then extended and extrapolated with the aid of ground measurements in order to arrive at estimates of the radiative components of the total energy budget for these targets. Author (GRA) 22;row, A;rrow, A

N72-15386# Little (Arthur D.), Inc., Cambridge, Mass.
EXPERIMENTAL AND THEORETICAL STUDIES OF LONG-PERIOD TILT OF EARTH'S CRUST. PART 2: THEORETICAL Final Report, 9 Dec. 1969 - 9 Jul. 1971
Robert K. McConnell, Jr. 9 Jul. 1971 56 p refs
(Contract F19628-70-C-0080; AF Proj. 8607)
(AD-729917; AFCRL-71-0388-Pt-2) Avail: NTIS CSCL 08/7

The theory of tilting of a layered elastic half-space under harmonic, point, and distributed loads whose amplitudes vary with time is developed. The tilting of continental and oceanic models for the crust and upper mantle under point loads are then computed and combined with published values of the offshore tide distribution to predict semi-diurnal tilts at Bedford, Massachusetts. The theoretical results compare favorably with preliminary observations using the borehole biaxial tiltmeters. Author (GRA)

N72-15387# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Library Section.
ISOSTATIC GRAVITY ANOMALIES IN THE BLACK SEA BASIN
M. E. Artemev Jul. 1971 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Zemli (USSR), no. 1, 1971 p 45-50
(AD-729904; ACIC-TC-1752) Avail: NTIS CSCL 08/5

Isostatic anomalies of the Black Sea and adjacent areas are considered. A block structure of the sea bottom is projected. Considerations are expressed on the nature of the anomalies and the place of the Black Sea Basin among other basins of the Mediterranean type. Author (GRA)

N72-15388# Stanford Univ., Calif. Stanford Electronics Labs.
PROGNOSTICATION OF IONOSPHERIC ELECTRON CONTENT, VOLUME 2 Final Report
Helio Waldman and Aldo V. DaRosa Aug. 1971 254 p refs
(Contract F04701-70-C-0233)
(AD-731096; SU-SEL-71-047-Vol-2; SAMSO-TR-71-82-Vol-2) Avail: NTIS CSCL 04/1

The report contains the 4 appendices to volume 1, N72-15397 095. The titles are the following: Data processing; List of progress reports; Additional investigations of 'Fourier series-solar/geophysical activity index' algorithms; Tables of evaluation results. GRA

N72-15389# Physics International Co., San Leandro, Calif.
IN-SITU DETERMINATION OF CONSITUTIVE RELATIONS OF GEOLOGIC MATERIALS
Theodore F. Stubbs Aug. 1971 71 p refs
(Contract ARPA HO-210015)
(AD-730109; PITR-311) Avail: NTIS CSCL 08/7

The calculations performed leading to specifications for a gauge system to determine the in-situ properties of natural materials through application of the conservation equations to stress data are described in this report. Conclusions are presented for the case of a spherically symmetric stress wave based upon a linear-elastic material model. Author (GRA)

N72-15390# Weidlinger (Paul) Consultants, New York.
MATHEMATICAL MODELS FOR GEOLOGICAL MATERIALS FOR WAVE PROPAGATION STUDIES
Ivan Nelson, Melvin L. Baron, and Ivan Sandler Mar. 1971 145 p refs
(Contract DASA01-69-C-0130; DASA Proj. NWER-XAXS)
(AD-729703; DASA-2672) Avail: NTIS CSCL 08/11

The paper presents a summary of the current state of the art in the mathematical modeling of the mechanical behavior of soil and rock over a range of environments in which the material can be considered to be a nonlinear hysteretic solid. These models have been developed for regions in which the pressure varies from peaks of tens of kilobars to fractions of a bar. They have been used in large finite difference and finite element computer codes to study ground shock problems. A general discussion and historical development of the mathematical models is presented. Detailed descriptions of the three basic types of models, i.e., elastic-ideally plastic, variable moduli and elastic-nonideally plastic (cap) models, and illustrative fits of these models to laboratory data are also given. While the paper deals primarily with strain rate independent models, an Appendix on strain rate dependent models is included. Author (GRA)

N72-15391# Lamont-Doherty Geological Observatory, Palisades, N.Y.
SEA FLOOR GEOTHERMAL MEASUREMENTS FROM VEMA CRUISE 24 Technical Report, 31 Jan. - 15 Dec. 1967
Marcus G. Langseth, Jr., Isabel Malone, Dee Breger et al Jul. 1971 464 p refs
(Contract N00014-67-A-0108-0004; Grants NSF GP-5356; NSF GP-1412; Task Order NR-083-142)
(AD-729682; TR-3-Cu-371; TR-1-CU-1-71; TR-1-CU-1-71) Avail: NTIS HC $6.00/MF $0.95 CSCL 08/10

The report presents geothermal data representing 216 stations in the Atlantic, Indian and Pacific Oceans. This material includes deep water and sediment temperatures as well as conductivity measurements from sediment cores. Author (GRA)

N72-15392# Wisconsin Univ., Madison.
EXPERIMENTAL ISOSTASY. PART 1: THE THEORY OF THE DETERMINATION OF THE EARTH'S ISOSTATIC RESPONSE TO A CONCENTRATED LOAD
LeRoy M. Dorman and Brian T. R. Lewis Sep. 1971 31 p refs
(Contract F44620-68-C-0087; AF Proj. 8652)
(AD-729935; Contrib-232-Pt-1; AFOSR-TR-71-2400) Avail: NTIS CSCL 08/5

In previous isostatic computations, the isostatic reduction of gravity data is made using an isostatic response function (the response of the earth's gravity field to a concentrated load on the earth's surface) derived for an assumed mechanism of compensation. In this report a method is given for the computation of this function directly from observational data, eliminating the need for assuming a compensation mechanism. Author (GRA)

N72-15393# Army Chemical Center, Edgewood, Md. Detection and Warning Lab.
PROCEEDINGS OF SECOND MEETING ON ENVIRONMENTAL POLLUTION
Solomon Love, comp. Aug. 1971 218 p refs Conf. held at Edgewood Arsenal, Md., 24-25 Mar. 1971; sponsored by Am. Ordnance Assoc.
(AD-729929; EA-SP-100-102) Avail: NTIS CSCL 13/2

The titles of the reports presented include: The joint role of Department of Defense and industry in protecting the environment; Changes in Federal organization for environmental control - changes flowing from the establishment of the Environmental Protection Agency; The air pollution story in Allegheny County; 'Can the urban environment be managed'; Federal program for air monitoring technology; M34 demilitarization program Task Force EAGLE; Detection and protection aspects of Project EAGLE; Consideration in remote raman spectroscopy; Maryland's state and local air quality control agencies 'routine comprehensive air monitoring system'; Problems in meeting emission standards; The Environmental Protection Agency R and D program for water quality control; Nuclear power and the environment; Edgewood Arsenal's test area ecology program; Solid waste disposal from the state's point of view; Handling and incineration of pesticides, plastics, and hazardous chemicals; Advanced fluid bed incinerator. GRA

N72-15394# Advanced Research Projects Agency, Washington, D.C.
COPIES OF PAPERS PRESENTED AT WOOD'S HOLE CONFERENCE ON SEISMIC DISCRIMINATION, VOLUME 1
1971 363 p refs
(AD-729247; ARPA-TIO-71-11-Vol-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 08/11

Contents: Opening presentation ARPA symposium on seismic discrimination; Theoretical M(s)-m(b) relation for small magnitudes; Earthquakes and explosion magnitudes: the effect of lateral variation of seismic attenuation; Analysis of long period noise at LASA; Long-period earth noise and the detection of and discrimination between earthquakes and underground explosions, etc. GRA

N72-15395# Texas A&M Univ., College Station. Dept. of Oceanography.
THE GENERAL CIRCULATION IN THE GULF OF MEXICO AS A TWO-LAYER BASIN
Takashi Ichiye Aug. 1971 58 p refs
(Contract N00014-68-A-0308-0002; Grant NSF GA-26498; A/M Proj. 711; A/M Proj. 700-4)
(AD-729013; A/M-Ref-71-21T) Avail: NTIS CSCL 08/3

The general circulation in the Gulf of Mexico is treated with two-layer ocean models. Scaling of vorticity equation for the upper layer with the motionless lower layer indicates that the inertia, horizontal eddy viscosity and wind-stress terms are unimportant compared with planetary vorticity and friction (proportional to velocity) terms for time scales longer than a few months and that a non-stationary motion like Loop Current may develop within a few weeks. Analytical solutions of the linearized transport vorticity equation with planetary vorticity and frictional terms are obtained by use of a Green function method for a rectangular, two-ports basin similar to the Gulf. An equation for change of the upper layer depth along a streamline is obtained from the integral relationships of the non-linear equations of motion. Author (GRA)

N72-15396# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Library Section.
ON THE INTERPRETATION OF THE GRAVITY ANOMALIES IN THE BAIKAL AREA
A. V. Ladynin Jul. 1971 13 p refs Transl. into ENGLISH from Geol. i Geofiz. (Novosibirsk, USSR), v. 3, no. 1, 1970 p 115-119
(AD-729906; ACIC-TC-1749) Avail: NTIS CSCL 08/5

The paper is a discussion of the author's attempt to find out the causes of the gravity anomalies in the Baikal area. The existing disagreements in the interpretation of gravity anomalies of the Baikal area are connected with a fundamentally different evaluation of the abyssal factors and of the isostatic state of the Baikal basin. The results of the author's attempt to find out the causes of the indicated deviations in interpretation are stated. Author (GRA)

N72-15397# Stanford Univ., Calif. Stanford Electronics Labs.
PROGNOSTICATION OF IONOSPHERIC ELECTRON CONTENT, VOLUME 1 Final Report
Helio Waldman and Aldo V. DaRosa Aug. 1971 98 p refs
(Contract F04701-70-C-0233; AF Proj. 6218)
(AD-731095; SU-SEL-71-046-Vol-1; SAMSO-TR-71-82-Vol-1) Avail: NTIS CSCL 04/1

The report describes two methods for the prognostication of the ionospheric electron content to be used in the correction of

ranging measurements made by the users of System 621B. One method is based on the generation of coefficients of electron content expansion as a function of the time of day, the day of the year and of an index of solar activity. This expansion permits the estimation of the electron content at a given number of reference locations. The electron content at another location is obtained by means of a geographical extrapolation. The second method, an extension of the first, attempts to improve the prognosticated values by an updating technique which uses near real time measurements of electron content made at some convenient location. Procedures for the implementation of the prognostication methods within the framework of System 621B are suggested. An error analysis for prognostication of the electron content over the North American area is presented.
Author (GRA)

N72-15398# Lincoln Lab., Mass. Inst. of Tech., Lexington.
STATISTICS OF THE SPECTRAL RATIO AND LOG-LIKELIHOOD RATIO SEISMIC DISCRIMINANTS
Manouchehr Mohajeri 24 Sep. 1971 23 p refs
(Contract F19628-70-C-0230; ARPA Order 512)
(AD-731158; TN-1971-33; ESD-TR-71-270) Avail: NTIS CSCL 08/11

The effect of noise variations on two of the short period seismic discriminants, spectral ratio and log-likelihood ratio, is studied. The mean square errors of two different estimators of these two discriminants are evaluated and some theoretical and experimental results for two seismic signals in seismic noise are presented.
Author (GRA)

N72-15399# Woods Hole Oceanographic Institution, Mass.
A COMPOSITION OF MOORED CURRENT METER AND WIND OBSERVATIONS. VOLUME 5: 1966 MEASUREMENTS
Ferris Webster and Susan Tarbell Jul. 1971 141 p refs
(Contract N00014-66-C-0241; NR Proj. 083-004)
(AD-730466; WHOI-Ref-71-50) Avail: NTIS CSCL 08/3

Summaries of wind and current measurements made with current meters and wind recorders by the Woods Hole Oceanographic Institution during the year 1966 are presented. Averaged quantities in computer-generated output as histograms, basic statistics, spectra, progressive vector diagrams, and east-north component plots.
Author (GRA)

N72-15400# Rome Air Development Center, Griffiss AFB, N.Y.
HF ELECTRON DENSITY MEASUREMENTS UNDER PROJECT BIRDSEED
Richard A. Schneible and Frederick C. Wilson Sep. 1971 19 p
(ARPA Order 10570000)
(AD-731157; RADC-TR-71-167) Avail: NTIS CSCL 04/1

The report describes the experiment plan, equipment and data collection and reduction procedures used in the RADC HF sounding experiment carried out under AEC Project BIRDSEED. This experiment was designed to measure the electron density produced by high altitude barium releases. Time histories of the electron density produced by releases SAPSUCKER and TITMOUSE are presented. They are of an order of magnitude smaller in magnitude than produced by various releases of comparable size. They also show a different characteristic shape.
Author (GRA)

N72-15401# Institute for Telecommunication Sciences, Boulder, Colo.
ON CALCULATING TRANSIENT ELECTROMAGNETIC FIELDS OF A SMALL CURRENT-CARRYING LOOP OVER A HOMOGENEOUS EARTH
James R. Wait and Randolph H. Ott 14 Jul. 1971 14 p refs
(Contract PRO-Y-71-872; Task-563506)
(AD-730339; AFCRL-71-0386) Avail: NTIS CSCL 08/7

The basic theory of airborne EM surveying, in the time domain, is considered. Rather than resorting to tedious double numerical integration, a more direct approach is adopted. This method, valid in the quasi-static regime, is illustrated for a homogeneous flat earth. The results exhibit a number of clear-cut features that are relevant to remote sensing. For example, a vertical co-axial loop system has a desirable transient response from the standpoint of yielding conductivity data without requiring accurate information on the height of the device above the ground.
Author (GRA)

N72-15402# Air Force Cambridge Research Labs., Bedford, Mass.
A NUMERICAL MODEL FOR INVESTIGATION OF OZONE TRANSPORT IN THE ATMOSPHERE Environmental Research Papers
Louis Berkofsky and Shoshana Gyoeri 24 Jun. 1971 44 p refs
(AF Proj. 8604)
(AD-731173; AFCRL-71-0367; AFCRL-ERP-358) Avail: NTIS CSCL 04/1

A zonally averaged model, including photochemistry, is devised to study the effects of transport by mean meridional motions and eddy diffusion upon the ozone concentration. The model contains twenty-two levels in the vertical from the ground to 66 km and eighteen grid points, from pole to pole, in the horizontal. In the paper, investigations are limited to effects of mean meridional motions. Numerical integrations are carried out for a period of two years. Results show that the model reproduces the annual period of the atmosphere. While mean meridional motions do transport ozone away from tropical regions, they are not sufficient to account for the observed buildup of ozone in high latitudes.
Author (GRA)

N72-15403# Air Force Cambridge Research Labs., Bedford, Mass.
THE BEHAVIOR OF THE F REGION ABOVE NORTH AMERICA DURING THE MAGNETIC DISTURBANCE OF 28 MAY 1970 Environmental Research Papers
Charles M. Rush 10 Aug. 1971 22 p refs
(ILIR Proj. 4-70; AF Proj. 6801)
(AD-731174; AFCRL-71-0426; AFCRL-ERP-370) Avail: NTIS CSCL 04/1

The electron density distribution of the F region above the North American continent is studied in detail during a magnetic disturbance that occurred on 28 May 1970. Using profiles deduced from vertical incidence ionograms recorded at 11 ionosonde locations, it is seen that the maximum electron density, the height of the maximum density and the semi-thickness of the F region are severely modified during the course of the disturbance. The behavior of the ionosphere during the most disturbed phase of the magnetic storm is such that the disturbance associated effects are seen over the entire continent. The recovery of the ionosphere toward normal conditions does not show the same spatial extent, however. It is seen that the rate at which the ionosphere above a specific location recovers depends not only on the latitude but also the longitude of the location. This would seem to indicate that there is much local control in the behavior of the ionosphere during the recovery portion of magnetic storm.
Author (GRA)

N72-15404*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTERPLANETARY MAGNETIC SECTOR POLARITY INFERRED FROM POLAR GEOMAGNETIC FIELD OBSERVATIONS
Eigil Friis-Christensen (Meteorologisk Inst.), Knud Lassen (Meteorologisk Inst.), John M. Wilcox (Calif. Univ., Berkeley), Walter Gonzalez (Calif. Univ., Berkeley), and David S. Colburn 8 Jul. 1971 7 p refs Submitted for publication Prepared by Calif. Univ., Berkeley
(Grant NGL-05-003-230; Contract N00014-69-A-0200-1049; Grant NSF GA-16765; NR Proj. 021-109)
(NASA-TM-X-67602; AD-727986; SSL-Ser-12-Issue-54) Avail: NTIS CSCL 03B

An influence of the interplanetary sector polarity on the

diurnal variation of the polar geomagnetic field is discussed. With the use of a prediction technique it is shown that the polarity (toward or away from the sun) of the interplanetary magnetic field can be reliably inferred from observations of the polar geomagnetic field. The sector polarity was inferred by visual inspections of magnetograms and no scaling or computing was performed. Author

N72-15405# Denver Univ., Colo. Dept. of Geography.
SCALE PROBLEMS IN GEOGRAPHIC RESEARCH Final Technical Report
Thomas M. Griffiths and Claude J. Doiron, Jr. 31 Jul. 1971 202 p refs
(Contract DAAK02-70-C-0334)
(AD-731286; ETL-CR-71-16) Avail: NTIS CSCL 08/6

Considerations of scale underlie geographical study in all of its aspects. It is only slightly less in scope, in this respect, than the whole of the discipline. Reductionism in geography is necessary because of the great size of the earth, its numerous geographical elements, and the broad scope of geography. This scale of reality (1:1) must be reduced in order to study the areal variation of geography. Both perception and conceptualization have important scale implications. Geographers must frequently devise their own scales and must ensure that they measure what they are said to measure. In geography, scale means measurement and, more specifically, the preciseness of measurement. Generalization and measurement must be differentiated in geography. Generalization belongs to hypothesis and theory; measurement belongs to empirical observation and the real world. Geographers have accepted scale as inherent in the profession but possibly have not regarded it commensurately with its true significance. Most geographic research is being conducted at small scales (63%) while only eight percent is at large scale. Thematic and special purpose mapping have deep scale considerations which are principally lodged in conceptualization, centered around the use of areal data as point data. The two principal scale applications, the reduction of area and the measurement of geographical associations and variations, require further specific and detailed study and research. Author (GRA)

N72-15406*# Aerospace Corp., El Segundo, Calif. Lab. Operations.
QUIET-TIME OBSERVATION OF A COHERENT COMPRESSIONAL Pc-4 MICROPULSATION AT SYNCHRONOUS ALTITUDE
George A. Paulikas, Michael Schultz, Joseph Barfield (UCLA), Louis J. Lanzerotti (Bell Telephone Labs.), and Carol G. MacLennan (Bell Telephone Labs.) 15 Jul. 1971 22 p refs
(Grant NGR-05-007-004; Contract F04701-71-C-0172)
(NASA-CR-125443; SAMSO-TR-71-148; AD-727002; TR-0172(2260-20)-5) Avail: NTIS CSCL 08N

During a magnetically quiet interval (1740 to 1850 UT), on 14 February 1967, the magnetic field intensity and energetic electron fluxes (E about = 0.3 to 2.0 MeV) at ATS 1 exhibited coherent modulations having a frequency of 33.8 cph (period about = 106.5 sec) and a duration of approximately 40 oscillations. The electron fluxes and magnetic field oscillated in phase. The field perturbation reached 8 gamma (peak to peak) in the direction of the unperturbed geomagnetic field. The transverse component of the field perturbation was practically zero. The characteristics of the observed oscillations appear to be compatible with those of a compressional (magnetosonic) excitation of the outer magnetosphere. The substantially radial normal mode is perhaps driven by a bounce-resonant interaction with the 15-keV protons that populate the quiet day ring current. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N72-15407 National Lending Library for Science and Technology, Boston Spa (England).
LAYER BY LAYER MASS SPECTROGRAPHIC METHOD OF ANALYSIS
M. S. Chupakhin, G. E. Ramendik, and A. N. Yavriyan 22 Oct. 1971 11 p refs Transl. into ENGLISH from Zh. Anal. Khim. (USSR), v. 25, no. 7, Jul. 1970 p 1301-1308
(NLL-Trans-843-(9022.64)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The importance for introduction of the 'resolution in depth' characteristic, in connection with the layer-by-layer method for determining impurities in thin films, is reviewed. It is pointed out that resolution in depth, which can be achieved by a vacuum spark discharge, is determined by the minimum thickness of the prepared layers of the sample and by their plane-parallel configuration. For this reason, methods were investigated for obtaining a plane-parallel configuration of layers taken off as a result of spark erosion of the material. Results of the study include the following: (1) Conditions are determined for plane-parallel removal of layers of a sample by vacuum spark discharge. (2) The random error is determined, which is introduced into the results of layer-by-layer analysis, when sample layers of a given thickness are removed. (3) It is established that layers of a thickness of 1-micron can be reliably analyzed, in investigations of impurity distribution in thin semiconductor films, by the mass spectrographic method with the use of a vacuum discharge. D.L.G.

N72-15408# Joint Publications Research Service, Washington, D.C.
MAGNETOMETRY
17 Dec. 1971 52 p refs Transl. into ENGLISH from Geofiz. App. (Leningrad), no. 31, 1967 p 20-63
(JPRS-54727) Avail: NTIS

Discussions on the uses and measurement errors encountered in using various types of magnetometers are presented along with data on NMR analysis. For individual titles, see N72-15409 through N72-15414.

N72-15409# Joint Publications Research Service, Washington, D.C.
THE PROTON VECTOR MAGNETOMETER
V. I. Myukhkyurya *In its* Magnetometry 17 Dec. 1971 p 1-12 refs (See N72-15408 06-14)
Avail: NTIS

The operating principles of a proton magnetometer, using the compensational and three lengths method of measuring, are discussed. The magnetometer is used to measure the Z and H components of the earth's magnetic field for intensities up to 20,000 gamma. A general view of the instrument's receiving sector is illustrated. E.H.W.

N72-15410# Joint Publications Research Service, Washington, D.C.
ON THE ACCURACY OF THE RUBIDIUM VAPOR MAGNETOMETER
Y. D. Lomanyy and B. M. Yanovskiy *In its* Magnetometry 17 Dec. 1971 p 13-17 refs (See N72-15408 06-14)
Avail: NTIS

The rubidium vapor magnetometer, used to measure the displacement of a series of F-2 peak frequencies, is described.

The effects of temperature, light intensity, and instrument orientation were considered in the measurements. The accuracy of the instrument was determined to be + or - .02 gamma for a change in temperature of 1 degree. It was found that a change in the intensity of the light source caused the peak frequency to be displaced .07 to + or - .02 gamma. Attempts to detect peak frequency displacement by changing the inclination angle of the instrument's optical axis were unsuccessful. E.H.W.

N72-15411# Joint Publications Research Service, Washington, D.C.
THE USE OF DYNAMIC POLARIZATION IN AN AIRBORNE NUCLEAR-PRECESSION MAGNETOMETER
Ye. P. Korennoy, V. S. Tsirel, and G. Ya. Yakovlev *In its* Magnetometry 17 Dec. 1971 p 18-23 refs (See N72-15408 06-14)
Avail: NTIS

The theories and principles of constructing an airborne nuclear precession magnetometer are cited. The apparatus for receiving the nuclear precession signals consists of a two frequency head sensor, a metric wave generator, a communication circuit, a circuit for shaping reversible impulses, and a preamplifier, all of which are located in a container towed by an aircraft. The auxiliary apparatus for observing the signal is located inside the aircraft. Diagrams are given of the equipment. Author

N72-15412# Joint Publications Research Service, Washington, D.C.
VIBRATIONAL ERRORS IN AN AIRBORNE MAGNETOMETER
V. L. Kantorovich, B. F. Midtsev, and V. A. Shilov *In its* Magnetometry 17 Dec. 1971 p 24-32 refs (See N72-15408 06-14)
Avail: NTIS

The errors caused by vibrations when a magnetometer's orientation unit of sensitive elements (UOChe) is placed in an aircraft fin, are discussed. It was shown that such errors are caused by geometric orientation, electrical orientation errors, and vibrational errors of the measuring system. Results indicate such errors may be removed by improving the UOChe shock absorbing system, increasing the MF's resistance to vibration, using quadratic compensation for geometrical orientation, and decreasing the effects of nonlinear high frequency interference transformation into low frequency signals in the electric circuit. E.H.W.

N72-15413# Joint Publications Research Service, Washington, D.C.
ON THE POSSIBILITIES OF USING NUCLEAR MAGNETIC RESONANCE FOR THE ELEMENTARY ANALYSIS OF MATTER c24
A. M. Sazonov *In its* Magnetometry 17 Dec. 1971 p 33-45 refs (See N72-15408 06-14)
Avail: NTIS

The possibilities of conducting qualitative and quantitative analyses of isotopic matter, paramagnetic ions in different media, and moisture content in a variety of substances using NMR, are examined. Results indicate that for paramagnetic ions and moisture content errors range from 10% to 20% and .5% respectively. For the isotopic matter, H, B-10, B-11, and F-19, results were consistent with previous measurements; however, relaxation times, intensity, and line width placed certain limits on measurements. The isotopes were measured in both solid and liquid states. It was shown that resonance lines in solids resembled the Gauss-type curve while those of liquids resembled the Lorentz type curve. E.H.W.

N72-15414# Joint Publications Research Service, Washington, D.C.
ON THE PROBLEM OF MAKING MEASUREMENTS WITH AN ASTATIC MAGNETOMETER
E. Ye. Reznik *In its* Magnetometry 17 Dec. 1971 p 46-51 refs (See N72-15408 06-14)
Avail: NTIS

The process of measuring the intensity of a sample's magnetization with a two magnetic astatic system is described. The sample's field is represented as a tensor which allows the measuring sequence to be chosen more efficiently for different locations, a decrease in measurement error, and a determination of additional possibilities for measuring the components of the sample's magnetization intensity. The deflection of the system is determined by two systems of Poisson equations. E.H.W.

N72-15415*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS FOR PHOTOGRAPHING METERS Patent Application
Gale A. Harvey, inventor (to NASA) Filed 16 Dec. 1970 8 p (NASA-Case-LAR-10226-1; US-Patent-Appl-SN-98774) Avail: NTIS CSCL 14E

The invention consists essentially of a camera and a photomultiplier pointed in the direction of the area in the sky to be photographed. When a meteor is in this area the resulting increase in light intensity causes the photomultiplier to produce an increased electrical signal. Means are provided which are responsive to this increased signal for opening the shutter of the camera. When the electrical signal decreases back to its normal value, the shutter closes. Hence, the film in the camera is exposed only while a meteor is in the selected area of the sky. The means for opening the shutter includes a relay which has the electrical signal from the photomultiplier applied to its coil. When the electrical signal increases to a predetermined value the contacts of the relay close and apply a voltage to a rotary solenoid. Capacitor means are provided to apply a large current to the solenoid at the instant the contacts of the relay close to overcome the inertia of the shutter making the shutter open faster. NASA

N72-15416*# Research Triangle Inst., Durham, N.C.
THIN FILM OXYGEN PARTIAL PRESSURE SENSOR
J. J. Wortman, J. W. Harrison, H. L. Honbarrier, and J. Yen (N.C. State Univ.) Washington NASA Jan. 1972 90 p refs (Contract NAS1-9827)
(NASA-CR-1941) Avail: NTIS CSCL 14B

The development is described of a laboratory model oxygen partial pressure sensor using a sputtered zinc oxide thin film. The film is operated at about 400 C through the use of a miniature silicon bar. Because of the unique resistance versus temperature relation of the silicon bar, control of the operational temperature is achieved by controlling the resistance. A circuit for accomplishing this is described. The response of sputtered zinc oxide films of various thicknesses to oxygen, nitrogen, argon, carbon dioxide, and water vapor caused a change in the film resistance. Over a large range, film conductance varied approximately as the square root of the oxygen partial pressure. The presence of water vapor in the gas stream caused a shift in the film conductance at a given oxygen partial pressure. A theoretical model is presented to explain the characteristic features of the zinc oxide response to oxygen. Author

N72-15417*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUDIO FREQUENCY MARKER SYSTEM Patent Application
Edward A. Cohen and Stanley L. Manatt, inventors (to NASA) Filed 11 Aug. 1970 15 p
(Contract NAS7-100)
(NASA-Case-NPO-11147; US-Patent-Appl-SN-63195) Avail: NTIS CSCL 14B

A system for providing a precise temporal display, or record, of the frequencies through which a sweeping audio frequency signal is swept, is disclosed. A sweeping audio frequency signal, of which the exact frequency with respect to time is unknown, is applied as an input to a pulse generator for the purpose of generating a train of pulses having a pulse repetition rate which

is the same as the frequency of the applied signals. The train of pulses is applied to a mixer circuit for the purpose of being mixed with a signal having a known frequency with respect to time. The beat frequency signals generated by the mixer circuit are applied to an appropriate display device, such as a chart recorder, for the purpose of providing the desired display or record. NASA

N72-15418*# North American Rockwell Corp., Downey, Calif.
AN IMPACT MONITORING APPARATUS Patent Application
Leland O. Mortensen, inventor (to NASA) Filed 2 Dec. 1970 12 p
(Contract NAS9-150)
(NASA-Case-MSC-15626-1; US-Patent-Appl-SN-94374) Avail: NTIS CSCL 14B

An impact monitoring apparatus for indicating and recording the magnitude of force imposed in a specific direction on a particular axis of interest comprises two parallel sawtooth leaf springs mounted in cantilever fashion one above the other. The upper leaf spring supports at its free end a designated mass. Upon experiencing a force or shock along the axis of interest, the free ends of the springs are deflected so that the sawtooth portions mechanically engage and lock. Movement of the upper spring is amplified by the mass. Engagement of the springs occurs along a length from the free end, the extent of engagement being proportional to the magnitude of the force experienced. NASA

N72-15419*# National Aeronautics and Space Administration, Washington, D.C.
SELECTED PHOTOGRAPHIC TECHNIQUES, A COMPILATION Technology Utilization
[1971] 31 p
(NASA-SP-5914(02)) Avail: NTIS CSCL 14E

A selection has been made of methods, devices, and techniques developed in the field of photography during implementation of space and nuclear research projects. These items include many adaptations, variations, and modifications to standard hardware and practice, and should prove interesting to both amateur and professional photographers and photographic technicians. This compilation is divided into two sections. The first section presents techniques and devices that have been found useful in making photolab work simpler, more productive, and higher in quality. Section two deals with modifications to and special applications for existing photographic equipment. Author

N72-15420*# Rocketdyne, Canoga Park, Calif.
DROPLET MONITORING PROBE Patent Application
James R. Baughman, inventor (to NASA) and Paul C. Thys Filed 23 Sep. 1970 14 p
(Contract NAS7-391)
(NASA-Case-NPO-10985; US-Patent-Appl-SN-74759) Avail: NTIS CSCL 14B

A droplet monitoring probe for use in analysis of droplet propagation in a mixed-phase fluid stream is discussed. The action of the probe is based on the change in electrical conductivity of two wires as caused by the impingement of liquid droplets. Measurement of the changes in direct current potential produces the droplet propagation data. NASA

N72-15421*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIGHT DIRECTION SENSOR Patent Application
Alan R. Johnston, inventor (to NASA) Filed 1 Oct. 1970 13 p
(Contract NAS7-100)
(NASA-Case-NPO-11201; US-Patent-Appl-SN-77220) Avail: NTIS CSCL 20F

Light sensing devices and, more particularly, a light sensing device for controlling orientation of an object relative to the sun or other light source are discussed. The light direction sensor consists of a direction-sensitive modulator positioned before a set of telescopic light gathering optics which, in turn, is followed by a detector. The direction-sensitive modulator consists of a birefringent crystal coupled with an electro-optic phase modulator positioned between a pair of crossed polarizers. The telescopic light gathering optics consist of an objective lens, field stop and field lens while the detector is a photomultiplier. The birefringent crystal is cut at a suitable angle so that the retardation suffered by a light beam would be dependent upon the direction of propogation of the light beam. NASA

N72-15422*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIGHT SENSOR Patent Application
Louis F. Schmidt, inventor (to NASA) Filed 22 Jul. 1970 13 p
(Contract NAS7-100)
(NASA-Case-NPO-11311; US-Patent-Appl-SN-57252) Avail: NTIS CSCL 20F

A light sensing device for controlling orientation of an object relative to the sun or other light source and the optical lens system for this purpose are described. The objective lens is capable of producing a backwardly curving image plane of a starfield which matches the similarly curved surface of the photocathode of an image dissector tube. An objective lens system for a conventional image dissector tube that eliminates the need for a specially designed faceplate utilizing fiber-optics completes the system. NASA

N72-15423*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GEOMETRIC FACTOR OF A CYLINDRICAL PLATE ELECTROSTATIC ANALYZER
A. D. Johnstone Nov. 1971 55 p refs
(NASA-TM-X-65786; X-646-71-473) Avail: NTIS CSCL 14B

A method for calculating the geometric factor of cylindrical plate electrostatic energy analyzers with various detector geometries is described. The effects of the fringe-field are estimated. For a special simple case an exact geometric factor is calculated enabling an estimate of the inaccuracies of the approximations used in other cases. The results of some calculations are presented and a simple approximate expression for the geometric factor is deduced. Author

N72-15424# Du Pont de Nemours (E. I.) and Co., Wilmington, Del. Film Research Lab.
SURFACE ANALYSIS BY X-RAY PHOTOELECTRON SPECTROSCOPY
R. C. Wendt and W. M. Riggs [1971] 31 p refs
Avail: NTIS

Electron spectroscopy is the technique of determining the binding energy of electrons in molecules by measuring the kinetic energy of the electrons emitted when a molecule interacts with photons. The usefulness of X-ray photoelectron spectroscopy as a surface analytical tool is discussed. It can detect most elements and can further identify specific chemistry via chemical shifts. Quantitatively it can be used to determine the empirical formula of a pure compound or relative atom concentrations in mixtures. It is particularly effective for surface analysis because it sees A, or less, and has extreme sensitivity for monolayers of most elements. When surface composition is known, it can be used to determine layer thickness. Author

N72-15425*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FIXTURE FOR SUPPORTING ARTICLES DURING VIBRATION TESTS Patent Application
David J. Light, inventor (to NASA) Filed 5 Oct. 1970 12 p
(NASA-Case-MFS-20523; US-Patent-Appl-SN-77786) Avail: NTIS CSCL 14B

A fixture is described for supporting and securing articles, such as electrical components, during vibration testing of the articles. It comprises an integral annular unit with series of

spaced blind cavities in its top surface and around its outer surface. Articles to be tested are secured in the cavities of the fixture, and the fixture is mounted on the driver head of a vibration exciter whereby the fixture is aligned with the driver coil of the exciter. The cavities may be in the form of partially threaded bores with an intermediate shoulder to receive a disk and a clamping nut for securing test items in the bores. NASA

N72-15426*# IIT Research Inst., Chicago, Ill.
JUNCTION RANGE FINDER Patent Application
Sarto Morissette, Ronald G. Sea, and Marvin J. Frazier, inventors (to NASA) Filed 21 Sep. 1970 16 p
(Contract NAS10-3755)
(NASA-Case-KSC-10108; US-Patent-Appl-SN-73922) Avail: NTIS CSCL 14B

An apparatus is described for locating electrically nonlinear objects and determining distance to the object. A frequency modulated signal is transmitted in the vicinity of the nonlinear object causing a signal of higher harmonic to be reflected by the nonlinear object. A receiver compares the harmonic with the initial exciting signal and produces a composite signal, the amplitude of which is directly proportional to the distance to the object. NASA

N72-15427*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
ACOUSTICAL TRANSDUCER CALIBRATING SYSTEM AND APPARATUS Patent Application
T. L. Lewis and R. B. Cohn, inventors (to NASA) Filed 14 Oct. 1971 11 p
(NASA-Case-FRC-10060; US-Patent-Appl-SN-189290) Avail: NTIS CSCL 14B

An acoustical transducer calibrating system is described which includes a differential pressure actuating device, with an inner chamber for applying differential pressures to the transducer under test, and an outer chamber for vacuum sealing the device to the surface under test. Mounted within the inner chamber is an electrostatic actuator for exciting the transducer at selected frequencies so that its sensitivity can be determined for different operating ambient pressures. NASA

N72-15428# Lund Observatory (Sweden).
THE COMPUTER CONTROLLED MICRO-PHOTOMETER AT THE LUND OBSERVATORY
Goesta Lynga and Goeran Arinder 1972 16 p
(Rept-4) Avail: NTIS

The microphotometer was rebuilt and equipped with computer control. It is efficient to measure spectra with the interpretative language BASIC. The flexibility obtained by this method makes possible great variations in computer programs, which combine measurements and reductions. Author

N72-15429*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CYCLICALLY OPERABLE, OPTICAL SHUTTER Patent Application
Edwin F. Dobies, inventor (to NASA) Filed 15 Oct. 1970 30 p
(Contract NAS7-100)
(NASA-Case-NPO-10758; US-Patent-Appl-SN-81096) Avail: NTIS CSCL 14B

A shutter system is described which serves cyclically to interrupt a beam of radiation to provide pulsed radiation of selectable pulse widths. The shutter has particular utility as an optical shutter, since it is capable of transmitting single pulses of radiation through apertures having relatively large openings for a wide range of selectable time intervals. NASA

N72-15430*# National Bureau of Standards, Boulder, Colo.
FLOWMETER Patent Application
Daniel H. Weitzel, inventor (to NASA) Filed 31 Dec. 1970 8 p
(NASA-Order H-1323A)
(NASA-Case-MFS-20974; US-Patent-Appl-SN-103090) Avail: NTIS CSCL 14B

A flowmeter for determining the flow characteristics of a dielectric material in a conduit is described. The flowmeter will also measure the mass flow rate and determine the velocity of bubbles in the fluid. E.H.W.

N72-15431*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ADJUSTABLE FORCE PROBE Patent Application
Walter E. Kaspareck, Ben B. Swords, and Werner K. Rosinski, inventors (to NASA) Filed 17 Dec. 1970 13 p
(NASA-Case-MFS-20760; US-Patent-Appl-SN-99174) Avail: NTIS CSCL 14B

A hand operated device for applying an adjustable present force against an object to test its hardness or stability is described. The device was used primarily to apply a specified force against electrical contact pins friction fitted in sockets to test whether the pins were adequately secured. NASA

N72-15432*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MATERIAL TESTING SYSTEM Patent Application
Paul J. Gilley, inventor (to NASA) Filed 1 Dec. 1970 9 p
(NASA-Case-MFS-20673; US-Patent-Appl-SN-20673) Avail: NTIS CSCL 14B

A system for cyclically applying a varying load to a material under test is described. The system includes a load sensor which senses the magnitude of the load being applied to a material, and, upon sensing a selected magnitude of loading, causes the load to be maintained for a predetermined time before causing the system to resume cyclical loading. NASA

N72-15433*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A HOLOGRAPHIC SYSTEM THAT RECORDS FRONT-SURFACE DETAIL OF A SCENE MOVING AT HIGH VELOCITY
Robert L. Kurtz and H. Y. Loh (Va. Polytechnic Inst.) Washington Jan. 1972 93 p refs
(NASA-TR-R-380; M-442) Avail: NTIS CSCL 14B

A holographic technique that uses an elliptical orientation for the holographic arrangement is discussed. It is shown that the degree of image degradation is not only a function of exposure time but also of the system used. The form of the functional system dependence is given, as well as the results of several systems tested, which verify this dependence. It is further demonstrated that the important parameter is the total motion of the target. Using the experimentally determined resolution of front-surface detail from a target with a velocity of 17,546 centimeters per second, an upper limit on target velocity for resolution of front-surface detail for a given system can be predicted. Author

N72-15434# National Aviation Facilities Experimental Center, Atlantic City, N.J.
INERTIAL LOCATOR TEST AND EVALUATION Final Report, Jun. 1969 - Sep. 1971
John E. Walls Feb. 1972 79 p refs
(Proj. 212-301-03X)
(FAA-RD-72-3) Avail: NTIS

The design, development and evaluation of an Inertial Locator Equipment (ILE) are discussed. The ILE provides aircraft position information and on-board computer data processing for flight inspection of ground navigation facilities. An evaluation of the ILE performance was performed during flight tests. The ILE demonstrated a potential for performing inspection of instrument landing systems with inertial equipment. Author

N72-15435*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ALTIMETER AND RADIOMETER FOR A VENUS ORBITER

MISSION
J. W. Bryan and K. R. Richter Dec. 1971 22 p refs Submitted for publication
(NASA-TM-X-65795; X-551-71-494) Avail: NTIS CSCL 14B

The concept, constraints, and capabilities of a radar altimeter type contour mapper for a Venus orbiter mission are presented. The system was developed for the proposed planetary explorer universal bus concept. A system with a height precision of 30 meters over a surface area of 7200 square kilometers is achieved. Using this system and the orbit proposed in the orbiting bus concept, the northern hemisphere of Venus is mapped in one Venus day. The radar receiver system, is used in a radiometer mode to obtain a map of the diurnal and logitudinal variations of the Venus surface temperature with a resolution of 3.0 degrees Kelvin. Author

N72-15436# Decca Navigator Co., Ltd., London (England).
A DATA LOGGER FOR OCEANOGRAPHIC SURVEYS
W. St.J. White and P. Diederich [1969] 10 p refs
Avail: NTIS

Some of the problems associated with data collection and processing on board vessels used for hydrographic and oceanographic applications are described and, explanations are given of how these problems differ from those associated with data handling in industrial and similar processes. Descriptions are given of the techniques which were developed to solve the problems and an instrument (Print Log) is described which was developed to meet many of the requirements. Author

N72-15437# SACLANT ASW Research Center, la Spezia (Italy).
THE SACLANTCEN METEOROLOGICAL OCEANOGRAPHIC BUOY
Pierre Blavier, Andre deHaen, Vito Failla, and Riccardo Pesaresi 15 Apr. 1970 27 p
(AD-870496; SACLANTCEN-TM-151) Avail: NTIS
CSCL 13/10

A 37 m long spar buoy is described which, although primarily intended for specific accurate meteorological measurements, was designed as a very stable and rugged unmanned platform allowing a wide range of oceanographic and meteorological observations. It is equipped with a high-capacity, high-precision data acquisition and digital recording system and is now ready to receive a wide variety of meteorological and oceanographic probes in addition to its existing meteorological sensors. It is at present free-drifting but an anchoring device is being studied. At the moment, for operational reasons, the buoy is essentially self-recording, but the present small monitoring transmitter can be replaced by a standard medium-range data transmitting system. Author

N72-15438# Case Western Reserve Univ., Cleveland, Ohio. Div. of Metallurgy and Materials Science.
EXPERIMENTS IN HIGH VOLTAGE ELECTRON MICROSCOPY Progress Report, 31 Oct. 1970 - 31 Jul. 1971
T. E. Mitchell 1 Aug. 1971 10 p refs
(Contract AT(11-1)-2119)
(COO-2119-1) Avail: NTIS

Experiments are being conducted on high resolution selected area diffraction and in-situ electron radiation damage. The experiments include voids in a tungsten filament, crystallization in glass, and radiation damage in metals and calcium fluoride. NSA

N72-15439# California Univ., Berkeley. Lawrence Radiation Lab.
RAPID QUANTITATIVE ANALYSIS BY X-RAY SPECTROMETRY
Robert D. Giauque and Joseph M. Jaklevic Jul. 1971 22 p refs Presented at the 20th Ann. Conf. on Appl. of X-ray Analysis, Denver, 11 Aug. 1971
(Contract W-7405-eng-48)
(LBL-204; Conf-710802-3) Avail: NTIS

An X-ray fluorescence analysis method applicable to the case of fluorescent spectra excited with monoenergetic X-rays was developed. The technique employs a minimum number of calibration steps using single element thin film standards and depends upon theoretical cross sections and fluorescent yield data to interpolate from element to element. The samples are treated as thin films and corrections for absorption effects are easily determined. Enhancement effects, if not negligible, are minimized by sample dilution techniques or by selective excitation. Author

N72-15440# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
OBSERVATIONS ON THE PERIODIC RADIOMETRIC CALIBRATION OF PORTABLE PROTECTION DOSIMETERS
E. Casnati and G. Scarpa 22 Apr. 1971 30 p refs In ITALIAN
(RT/PROT-(71)16) Avail: AEC Depository Libraries

After a detailed analysis of the main parameters affecting the response of a dosimeter, some typical calibration protocols are proposed. In order to assess the actual behavior of routine instruments used in a radiation protection service, a preliminary survey was carried out both on portable exposure-rate meters and on personnel ion chamber dosimeters. Within each of the classes a distinction was made between new and used detectors. The study showed that, on the whole, the reproducibility of personnel dosimeters was distinctly better than that of exposure-rate meters. Furthermore, irrespective of the kind of instruments, no significant correlation was found between age and reproducibility of the detector, with the obvious exception of definitely worn out instruments. The results of this investigation strongly support the importance of regular calibrations to be carried out on the dosimetric devices, according to detailed protocols. Author (NSA)

N72-15441# Kansas State Univ., Manhattan. Dept. of Nuclear Engineering.
INTERCALIBRATION OF THE KSU NE-213 FAST NEUTRON SPECTROMETER SYSTEM
Walter Meyer, James W. Thiesing, and C. Michael Estes 19 Dec. 1970 50 p refs
(Contract AT(11-1)-2049)
(COO-2049-3) Avail: NTIS

Using a PoBe source and standard geometry supplied by ORNL (Source PN-19), a one hundred twenty (120) minute complex neutron spectrum was measured with the KSU NE-213 neutron spectrometer. The complex spectrum was unfolded with the ORNL code FERDOR. The KSU FERDOR result is compared with ORNL measurements made with the same PoBe source and also unfolded with the FERDOR code. A comparison is also made with a nuclear emulsion measured spectrum made with a different PoBe source. Using the KSU FERDOR results a source strength was calculated, (2.120 + or - 0.029) x 10 to the 9th power neutrons per min; this compares well with a time corrected source strength calculated from the source vender's reported strength of 2.11 x 10 to the 9th power neutrons per min. Author (NSA)

N72-15442# Japan Atomic Energy Research Inst., Tokyo.
MEASUREMENT OF THE FAST NEUTRON FLUXES IN AN EXPERIMENTAL CRITICAL ASSEMBLY. 1: FEASIBILITY STUDY OF THE DOPED GLASS DOSIMETER
Masayuki Nomura, R. Yokota, H. Imagawa, Y. Muto, and H. Tomishima Jan. 1971 20 p refs In JAPANESE; ENGLISH summary
(JAERI-Memo-4337) Avail: AEC Depository Libraries

The metaphosphate glass doped with fissionable material, a kind of fission track detector, is capable of measuring mono-energetic fast neutron fluxes even at a low dose rate. The applicability of this method, however, is not confirmed yet for polyenergetic fast neutron fluxes. A metaphosphate glass detector doped with natural uranium, depleted uranium, or thorium was prepared. With this detector, the fast neutron fluxes over an

energy range were measured in the JMTRC or low power (Max. 10W) with a neutron energy distribution. The detector developed was found to be able to measure the fluxes with an accuracy of 1 million n/sq. cm sec + or - 30% corresponding to the flux of energy over 1 MeV. Author (NSA)

N72-15443# Bendix Corp., Kansas City, Mo.
A STUDY OF THE FUNCTIONAL CAPABILITIES OF AN AIR-BEARING COMPRESSION TEST FIXTURE Interim Report
G. E. Martinette Jul. 1971 15 p
(Contract AT(29-1)-613)
(BDX-613-390) Avail: NTIS

New air-bearing compression test fixtures used in conjunction with universal testing machines were evaluated. The performance of the air-bearing fixtures was compared to the performance of sleeve-bearing fixtures which were in regular use. Based on the results of this study, the air-bearing sub-presses are being exclusively used for product acceptance testing. Author

N72-15444# Bendix Corp., Kansas City, Mo.
STUDY OF THE FUNCTIONAL CAPABILITIES OF A TOTAL AREA LOADING COMPRESSION TEST FIXTURE Interim Report
G. E. Martinette Jul. 1971 15 p
(Contract AT(29-1)-613)
(BDX-613-391; PDO-6984549) Avail: NTIS

A new fixture for total area load versus deflection testing of flat pads and cushions was evaluated and its capability compared to that of an existing fixture. It was determined that the new fixture was an improvement, and it is being used for acceptance testing of product. Author

N72-15445# Politecnico di Torino (Italy). Ist. di Macchine e Motori per Aeromobili.
USE OF A HOT-WIRE ANEMOMETER FOR MEASUREMENTS IN GAS STREAMS AT VARIABLE PRESSURE AND TEMPERATURE [SULL'IMPIEGO DEL-L'ANEMOMETRO A FILO CALDO PER MISURE IN CORRENTI GASSOSE A PRESSIONE E TEMPERATURE VARIABILI]
M. Andriano and G. Follis Jan. 1970 46 p refs In ITALIAN
(Publ-119) Avail: NTIS

A hot-wire anemometer for velocity measurements in gas streams at variable pressure and temperature was examined in order to design an instrument for velocity measurements of air inside the combustion chambers of an automobile engine. An algorithm taking into account both the gas pressure and temperature and the support temperature, and allowing various approximation was developed. The probe can be used both as a resistance thermometer and as a hot-wire anemometer. ESRO

N72-15446# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Lab. Central de Recherches.
ONBOARD ATOMIC CLOCK Final Report
J. P. Guillon 26 Nov. 1970 16 p In FRENCH Sponsored by Direc. de Rech. et Moyens d'Essais
(LCR-DR-1-70-174/1/R) Avail: NTIS

The development of an airborne atomic clock is described. To minimize power consumption two separate circuits were introduced for thermal regulation. The electronic circuit associated with the quartz crystal providing the frequency standard is described and the frequency stability is discussed. The power supply included provision for automatic switching from main to internal batteries and a battery charger was incorporated. Chemical and consumption tests were performed and gave good results. The time scale was easily shifted by steps of 200 nanoseconds. ESRO

N72-15447# Aeronautical Quality Assurance Directorate, Uxbridge (England).
UNCERTAINTIES OF MEASUREMENT
H. Gregory 1 Mar. 1971 31 p refs Presented at the AID Symp., Sep. 1966
(AQD-ENG-LABS-1) Avail: NTIS

Uncertainties of measurement are classified into systematics and accidentals. The application of the simple mathematical techniques for the assessment of the uncertainties of measurement is described. An appreciation of the problems posed in judging the risks of wrongful rejection or acceptance when the variability of the measured quantity is significant and its size approaches the specification limits, is discussed. Author (ESRO)

N72-15448# California Univ., Berkeley. Space Sciences Lab.
THE DEVELOPMENT OF AN INTERFEROMETER FOR MILLIMETER WAVELENGTHS Annual Report, 1 Jul. 1970 - 30 Jun. 1971
Richard Hills, Wilson Hoffman, Michael A. Jannssen, Douglas D. Thornton, and Samuel Silver Aug. 1971 96 p refs
(Contract N00014-69-A-0200-1047)
(AD-729108; SSL-Ser-12-Issue-64) Avail: NTIS CSCL 03/1

The report describes the development of an interferometer to operate at millimeter wavelengths. The two elements are the 20-foot millimeter antenna at the Hat Creek Observatory and the 10-foot dish that had been in use for millimeter work previously. The antenna separation is fixed at about 260 meters. The report describes the development of all the various components for the interferometer. These include: (a) the front end for the 10-foot dish, (b) the IF amplifiers, (c) the line equalizers, (d) the variable delay line, (e) the wide-band correlator, (f) the local oscillator system, (g) the multichannel spectrometer, (h) the digital components and computer interface, and (i) the computer control program. In addition, results are given for preliminary observations of the planet Venus and the quasar 3C84. Author (GRA)

N72-15449# Solar, San Diego, Calif.
RADIATION PYROMETER FOR GAS TURBINE BLADES Final Report, 8 Feb. 1970 - 16 Jun. 1971
David A. Rohy and W. A. Compton 16 Jun. 1971 115 p refs
(Contract N00019-69-C-0683)
(AD-730837; RDR-1698) Avail: NTIS CSCL 14/2

The report describes the results of a program that has advanced the concepts and practical feasibility of radiation pyrometry for measuring the first stage blade temperature in gas turbine engines. Thermal radiation is accepted from the blades by sensor heads employing one of two different optical systems. The two sensor heads were designed to collect thermal radiation from either a spot or a reasonably large area of the turbine blade. High temperature fiber optics have been used to transmit the radiation to a remote detector housing, where the photons are converted into an electrical signal by a silicon photovoltaic cell. The current produced by the cell is routed to a signal processor which amplifies the signal, extracts one of three desired signal characteristics and then produces an output signal directly proportional to the temperature. This system measures and displays on a real time basis the average temperature of blades on a wheel, the average of the highest temperatures on a wheel, or the temperature of the hottest blade on the wheel. Both analog and digital signal information is available. System response is better than 10 msec in most cases. End to end system accuracy when calibrated with an electrically heated strip target was better than plus or minus 10F across the range of 1400 and 2200F. Author (GRA)

N72-15450# Texas Instruments, Inc., Dallas. Services Group.
UNITED STATES COAST GUARD OCEANOGRAPHIC SENSOR STUDY. ENGINEERING DESIGN STUDY FOR A FIXED-PLATFORM DATA-ACQUISITION SYSTEM
W. J. Daniel, Gerald R. Schlechte, Evans E. Cayce, and Jack R. Willard Mar. 1971 362 p refs
(Contract DOT-CG-90505-A)
(AD-731164; TI-59009-6) Avail: NTIS HC $6.00/MF $0.95 CSCL 14/2

Contents: Sensor system; Primary power; Platform control and data transmission; Reliability; System definition; Analysis of

system reliability; Feasibility; Maintainability; References and bibliography. GRA

N72-15451# California Univ., Los Angeles. School of Engineering and Applied Science.
PULSE ECHO PATTERN ANALYZER
Wayne Thomas Armstrong Jun. 1971 93 p refs
(Contract N00014-69-A-0200-4018; NR Proj. 386-403)
(AD-731020; UCLA-ENG-7120) Avail: NTIS CSCL 14/2

The report presents an original design of an instrument called a Pulse Echo Pattern Analyzer (PEPA). Its main function is to automatically determine the best time constant of an exponentially decaying high frequency signal. The Pulse Echo Pattern (PEP) input signal can be either pulsed continuous, unipolar or bipolar. The carrier frequency and echo pulse width of the PEP are limited to 50 MHz and 200ns respectively. The time constant of the PEP is presented as a positive pulse whose width is equal to the time constant and is continuously updated in a manner that will average short duration perturbations while recording long term changes. The instrument measures the TC to an accuracy of plus or minus 2.5% and responds to time constant changes of 0.3%. Operation of the PEPA can be described as a digitially controlled analog processor. The time constant is obtained by sampling an internally generated exponentially decaying signal. This signal, called the reference exponential, is automatically adjusted to have a time constant representing a best fit to the input. Automatic adjustment of this time constant is accomplished by a feedback loop which acts to force the difference between the PEP and reference exponential to zero. The instrument can determine the time constant for a portion of the PEP as well as for all of it.
Author (GRA)

N72-15452# Atmospheric Sciences Office, White Sands Missile Range, N.Mex.
A CAPACITANCE ELECTRON DENSITY PROBE
Roberto Rubio, Jack Smith, and Donald Maxwell Fort Monmouth, N. J. ECOM Jun. 1971 37 p refs
(AD-731210; ECOM-5390; OSD-1366) Avail: NTIS CSCL 14/2

The design and operational characteristics of a rocket-borne, radio-frequency capacitance probe for obtaining electron densities in the 60-100 km altitude range are described. The design objective was to provide a simple, inexpensive system suitable for synoptic measurements of electron density. Basically the probe consists of a coaxial capacitor which is exposed to the atmosphere. This capacitor is the frequency control element of a 5MHz oscillator. As the dielectric constant is a function of the electron density within the capacitor dielectric, the oscillator frequency changes are related to electron density. A simple procedure, which ignored sheath effects, was used to calibrate the probes. Despite this calibration deficiency, electron densities derived from data obtained during two test flights were reasonable and agreed with results obtained from other experiments in this altitude region. Author (GRA)

N72-15453# Hardesty (George K. C.), Annapolis, Md.
DUO-PANEL LIGHT DISTRIBUTION TECHNIQUES FOR USE IN SHIPBOARD CONTROL AND INDICATING EQUIPMENTS
George K. C. Hardesty Washington NSRDC Oct. 1971 64 p refs
(Contract N00161-70-C-0739; NSRDC Proj. 1-624-104)
(AD-731370; NSRDC-6-103) Avail: NTIS CSCL 13/1

Principles and practices in the application of the Duo-Panel light distribution technique to the design of control and indicating equipments of ships and other military and weapons control systems are described. Design principles rather than contemporary design detail are emphasized. The bibliography includes a number of references in the field of practical design and in the evaluation of illuminated displays. Appendix B includes work sheets for the computation of the dark adaptation figures of merit 'cone-to-rod ratio' from spectral distribution data on the basis of the latest international (CIE) standards for photopic and scotopic vision. Also included is a sample specification potentially applicable to a variety of shipboard systems and other indicating, monitoring, and control equipments. Author (GRA)

N72-15454# Ballistic Research Labs., Aberdeen Proving Ground, Md.
TEMPERATURE TESTS OF HIGH PRESSURE TRANSDUCERS
C. D. Bullock Aug. 1971 22 p
(Pron Proj. A1-8-JH807-02-F6-AJ)
(AD-730640; BRL-MR-2115) Avail: NTIS CSCL 14/2

Tests were conducted to determine the effect of ambient temperature on several piezo-electric and strain gage pressure transducers used in high pressure gun measurements at the Interior Ballistics Laboratory (IBL) of the U.S. Army Aberdeen Research and Development Center (USAARDC). The transducers were statically calibrated at fixed temperatures from -50 to -150F in 50 increments to a maximum pressure of 50 Kpsi. The temperature coefficient of sensitivity for the samples tested varied from -0.016 to -0.25%/F. Author (GRA)

N72-15455# Battelle Memorial Inst., Columbus, Ohio.
GAS MONITORING EQUIPMENT INVESTIGATION Interim Report
R. E. Gannoe, G. R. Riley, and D. W. Frink 1971 124 p refs
(Contract N00014-69-C-0352)
(AD-730509) Avail: NTIS CSCL 14/2

Based on a study of diving requirements, the constituents selected for monitoring were: oxygen, carbon dioxide, carbon monoxide, water vapor (relative humidity), hydrocarbons, oxides of nitrogen, sulfur dioxide, and halogen compounds. Inquiries were sent to manufacturers of gas-analyzing equipment based on the following generally applicable principles: infrared analysis, ultraviolet analysis, orsat analysis, gas chromatography, mass spectrometry, and colorimetry. Inquiries were also sent concerning instruments suitable for only one gas, e.g., paramagnetic instruments for oxygen. Of particular interest in the search were instruments which would indicate the concentration of gas at elevated pressures. Author (GRA)

N72-15826 Texas Instruments, Inc., Dallas.
AN IMPROVED ELECTRODYNAMIC SHAKER SHOCK TECHNIQUE
J. R. Moser and D. Garner *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 173-181 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-15842 Army Transportation Engineering Agency, Fort Eustis, Va. Military Traffic Management and Terminal Service.
THRESHOLD TYPE RECORDERS
J. J. Pursifull *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 99-107 (See N72-15833 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-15854 Radiation, Inc., Melbourne, Fla.
DEVELOPMENT OF A SMALL TRANSMITTER FOR HIGH INTENSITY SHOCK ENVIRONMENT
E. L. Kirkley *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 85-91 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-15859 Massachusetts Inst. of Tech., Cambridge.
AIR DAMPED HIGH-g ACCELEROMETER AND WIDE BAND VELOCIMETER FOR SHOCK STUDY IN FREE MASS UNDER SEVERE AIR BLAST
Y. T. Li and S. Y. Lee *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 133-139 (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-15867 Naval Ship Research and Development Center, Washington, D.C.
AN ENVIRONMENTAL VIBRATION RECORDER
R. E. Schauer and W. P. Foster *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 225-232 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-15869 Naval Ship Research and Development Center, Washington, D.C.
PORTABLE INSTRUMENTS FOR USE IN CONNECTION WITH SHIPBOARD VIBRATIONS CODES
R. K. Brown and A. Hagen *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 243-247 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-15358# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
THE PHYSICS OF THE CHANNEL ELECTRON MULTIPLIER
C. Barat *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 231-239 refs (See N72-15339 06-13)
Avail: NTIS

N72-15359# Groupe de Recherches Ionospheriques, Paris (France).
FAST ANALYSIS OF PITCH ANGLE AND ENERGY DISTRIBUTION OF ENERGETIC PROTONS
J. Etcheto and B. de la Porte des Vaux *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 241-248 refs (See N72-15339 06-13)
Avail: NTIS

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication; friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N72-15456 National Lending Library for Science and Technology, Boston Spa (England).
DEVELOPMENT OF A BEARING FOR THE SPIN-CORRECTED ANTENNA OF A SPIN-STABILISED SPACE VEHICLE
M. Granzow [1971] 11 p Transl. into ENGLISH from Raumfahrtforsch. (Stuttgart), no. 2, 1970 p 69-74
(NLL-Risley-TR-2242-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Known bearing and lubrication systems were investigated with regard to a number of requirements for communications satellites. These included: (1) ability to function in space, (2) low power consumption for overcoming bearing friction, (3) high reliability with no maintenance during a five-year lifetime, (4) low weight, (5) a 100-mm clear passage through the center of the bearing, (6) alignment accuracy of the rotating axis with respect to stationary axis, (7) 20-g starting loads, and (8) magnetic purity. It was concluded that it is possible to keep an oil-vapor-lubricated antenna bearing system operating for five years with a minimum drive power of about five watts. The only drawback of this bearing is oil vapor leakage past the seals. This is of the order of 10 to the -8th power g/s or 5 x 10 to the -7th power torr. Tests done on dry-lubricated ball bearings of the same size showed inferior performance. K.P.D.

N72-15457 National Lending Library for Science and Technology, Boston Spa (England).
SYSTEM OPTIMIZATION BY RELIABILITY AND AVAILABILITY ANALYSIS
P. Daublebsky 8 Dec. 1971 14 p refs Transl. into ENGLISH from Atompraxis (Kaplsruhe), v. 16, Mar. 1970 p 77-82
(NLL-CE-Tr-5543-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A practical approach was developed so that a designer can optimize complex systems with the aid of reliability theory. A minimum reliability must be maintained. Weak spots and over dimensioned parts are discovered by varying the assumptions regarding the failure rates of individual components and varying the design itself. Given the boundary conditions on minimum reliability and capital costs, design changes are self-evident. The aim of the subsequent availability analysis is to find the most suitable of the versions still proposed. Availability is taken to mean the probability that a system is in order and is not in the process of being repaired. The most suitable system is the one for which the sum of m capital costs and availability losses is a minimum. Whether it will pay to install more expensive replacement parts can also be calculated. Author

N72-15458 National Lending Library for Science and Technology, Boston Spa (England).
OIL-FILM BREAKDOWN IN JOURNAL SHAFT-BEARINGS
H. Yabe Dec. 1971 20 p refs Transl. into ENGLISH from Junkatsu (Tokyo), v. 15, no. 8, 1970 p 478-484
(NLL-RTS-6561) Avail: Natl. Lending Library, Boston Spa, Engl.: £2.00 or 7 NLL photocopy coupons

The state of the oil film in a journal shaft bearing is discussed. The tendency for breakdowns in the oil film in areas beyond the point of minimum bearing clearance is examined. The effect of oil film discontinuity on the characteristics and performance of the journal bearing is described. Author

N72-15459*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRICTION AND WEAR OF SELECTED METALS AND OF CARBONS IN LIQUID NATURAL GAS
Donald W. Wisander Washington Dec. 1971 13 p refs
(NASA-TN-D-6613; E-6457) Avail: NTIS CSCL 11H

Friction and wear experiments were conducted with hemispherically tipped (4.76-mm radius) rider specimens in sliding contact with a rotating disk submerged in liquid natural gas (LNG). The program included metal combinations and carbon-metal combinations. These experiments revealed that the metal combinations were not lubricated by the LNG. Carbons had much lower wear in LNG than in liquid hydrogen or in liquid nitrogen. (Wear of carbon in liquid hydrogen was 100 times that in LNG.) The friction coefficients obtained in LNG (0.6 for metal-metal and 0.2 for carbon-metal) are similar to those obtained in liquid hydrogen. Author

N72-15460*# Planning Research Corp., Huntsville, Ala.
EVALUATION OF METHODS FOR DETERMINING HARDWARE PROJECTED LIFE

Nov. 1971 71 p refs
(Contract NAS8-21811)
(NASA-CR-121065; PRC-H-101) Avail: NTIS CSCL 14D

An investigation of existing methods of predicting hardware life is summarized by reviewing programs having long life requirements, current research efforts on long life problems, and technical papers reporting work on life predicting techniques. The results indicate that there are no accurate quantitative means to predict hardware life for system level hardware. The effectiveness of test programs and the cause of hardware failures is considered. Author

N72-15461*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SHORT-TERM HOT HARDNESS CHARACTERISTICS OF ROLLING-ELEMENT STEELS
James L. Chevalier, Marshall W. Dietrich, and Erwin V. Zaretsky Washington Jan. 1972 22 p refs
(NASA-TN-D-6632; E-6596) Avail: NTIS CSCL 13H

Short-term hot hardness studies were performed with five vacuum-melted steels at temperatures from 294 to 887 K (70 to 1140 F). Based upon a minimum Rockwell C hardness of 58, the temperature limitation on all materials studied was dependent on the initial room temperature hardness and the tempering temperature of each material. For the same room temperature hardness, the short-term hot hardness characteristics were identical and independent of material composition. An equation was developed to predict the short-term hardness at temperature as a function of initial room temperature hardness for AISI 52100, as well as the high-speed tool steels. Author

N72-15462*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CABLE RESTRAINT Patent Application
Harry V. Fuller, inventor (to NASA) Filed 17 Dec. 1970 13 p
(NASA-Case-LAR-10129-1; US-Patent-Appl-SN-99201) Avail: NTIS CSCL 13I

A device for receiving and controlling a cable is presented. The device permits substantially free movement of the cable in a first direction but resists cable movement in an opposite direction until the forces exerted exceed a predetermined minimum. After such a minimum is reached, the cable moves freely in the opposite direction. NASA

N72-15463*# North American Rockwell Corp., Seal Beach, Calif.
SATURN S-2 PRODUCTION OPERATIONS TECHNIQUES: PRODUCTION WELDING. VOLUME 1: BULKHEAD WELDING
O. G. Abel 30 Oct. 1970 314 p refs
(Contract NAS7-200)
(NASA-CR-123484; SD70-559-1) Avail: NTIS CSCL 13H

The complex Saturn S-2 welding processes and procedures required considerable development and refinement to establish a production capability that could consistently produce aluminum alloy welds within specified requirements. The special processes and techniques are defined that were established for the welding of gore-to-gore and manhole- or closeout-to-gore. D.L.G.

N72-15464*# North American Rockwell Corp., Seal Beach, Calif.
SATURN S-2 PRODUCTION OPERATIONS TECHNIQUES: PRODUCTION WELDING. VOLUME 2: CYLINDER WELDING
O. G. Abel 30 Oct. 1970 123 p refs
(Contract NAS7-200)
(NASA-CR-123486; SD70-559-2) Avail: NTIS CSCL 13H

The special processes and techniques are defined that were established for the vertical panel trim and weld operations to assemble Saturn S-2 cylinder assemblies. D.L.G.

N72-15465*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SHOCK ABSORBING DEVICE Patent Application
Albert Topits, Jr., inventor (to NASA) Filed 30 Jun. 1970 13 p
(Contract NAS7-100)
(NASA-Case-NPO-10626; US-Patent-Appl-SN-51246) Avail: NTIS CSCL 13I

A shock absorber for supporting bearings subjected to omnidirectional shock loading in a high g environment is described. The device includes a pair of annular parts arranged in a concentric relationship and interconnected through several radially directed, shock absorbing parts of an ogee configuration. These parts serve to couple the annular parts into a unitary structure so that an annular bearing race can be mounted on the innermost part and supported in a coaxial relationship with it, while the device operatively is supported at the surface of the outermost annular part. Consequently, each shock absorbing part is stressed independently as a shock loading of the device occurs. Due to their ogee configuration, the shock absorbing parts concurrently are strained and may simultaneously experience elongation, contraction, and rolling for dissipating stress-inducing shock loads, regardless of the direction of forces applied during shock loading of the device. NASA

N72-15466*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ADJUSTABLE SUPPORT Patent Application
Thomas W. Andrews, inventor (to NASA) Filed 31 Jul. 1970 9 p
(Contract NAS7-100)
(NASA-Case-NPO-10721; US-Patent-Appl-SN-59968) Avail: NTIS CSCL 13I

An adjustable support for varying the distance between a base and a supported member is described. An adjustable jacking screw provides a means by which the system may be locked or easily readjusted. The device allows limited universal movement of the member with respect to its base. E.H.W.

N72-15467*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
QUICK DISCONNECT COUPLING Patent Application
Allan R. McDougal and Douglas P. Davis, inventors (to NASA) Filed 21 Aug. 1970 30 p
(Contract NAS7-100)
(NASA-Case-NPO-11202; US-Patent-Appl-SN-66004) Avail: NTIS CSCL 13E

A quick-disconnect coupling particularly suited for use in coupling umbilical leads, including electrical cables and fluid conduits is described. The device is comprised of a pair of coaxially related coupling components interconnected through an annular array of balls. The system includes a sealed gas generator operatively associated with a locking ring for positively displacing the locking ring to release the balls, and an axially displaceable, actuating sleeve to initiate a positive separation of the coupling components as the balls are released. NASA

N72-15468*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LINEAR ACTUATOR Patent Application
Gerald S. Perkins, inventor (to NASA) Filed 31 Jul. 1970 16 p refs
(Contract NAS7-100)
(NASA-Case-NPO-11222; US-Patent-Appl-SN-59893) Avail: NTIS CSCL 13I

A compact, linear actuator particularly suited for use aboard spacecraft and the like is described. The actuator is characterized by an elongated output shaft, a ball-screw and nut assembly, and a reversible motor. A particular advantage of the actuator is the concentricity of the nut and motor which enhances compactness and efficiency of operation. The system is operated by rectilinear motion. NASA

N72-15469*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
GEYSERING INHIBITOR FOR VERTICAL CRYOGENIC TRANSFER PIPE Patent Application
Frank S. Howard, inventor (to NASA) Filed 31 Dec. 1970 10 p
(NASA-Case-KSC-10615; US-Patent-Appl-SN-103078) Avail: NTIS CSCL 13D

The geysering inhibitor utilizes a thin-wall tube carried within a vertical pipe used for transporting a liquid cryogen, to make space shuttle boosters aerodynamically stable, the heavy liquid oxygen tanks have to be placed forward or above the liquid hydrogen tanks. This requires a long vertical lox transfer pipe to extend between the lox tank and the main propulsion engines carried adjacent the bottom of the vehicles. A similar lox pipe is required on Saturn 5 first stage vehicles. Heat input from outside the pipe boils liquid oxygen in the vertical pipe. To minimize the geysering effect caused by the rising bubble or bubbles, an elongated vertical tube of less diameter than the suction pipe is carried within the suction pipe. In one configuration it was found that the diameter of the vertical pipe has an area approximately equal to the area of the annulus between the inhibitor pipe and the suction pipe. NASA

N72-15470*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FOLDABLE CONSTRUCTION BLOCK AND METHOD OF CONSTRUCTION Patent Application
William C. Huber, inventor (to NASA) Filed 18 Sep. 1970 18 p
(NASA-Case-MSC-12233-1; US-Patent-Appl-SN-73422) Avail: NTIS CSCL 13C

One variation of the apparatus includes an open-top construction block foldable from a flat sheet of material to form a container. It has downwardly extending interlock tabs, with struts between opposite vertical walls and diagonally opposed vertical joints to control horizontal expansion of the block when a solid material is placed therein. A second variant includes a closed top block foldable from a single sheet of material with interlock tabs extending downwardly from one side wall and interlock tab-receiving slots provided in the top of the block. The method of folding box-shaped containers is described using flat sheets of material. The containers are filled with available solid material and the containers stacked in overlapping courses so that the interlock tabs extend downwardly into similar containers in the underlying course. NASA

N72-15471*# North American Rockwell Corp., Seal Beach, Calif. Space Div.
SATURN S-2 QUALITY ASSURANCE TECHNIQUES: NONDESTRUCTIVE TESTING PROCESSES. VOLUME 1: REQUIREMENTS AND PROCEDURES
H. H. Eller and F. E. Sugg 30 Oct. 1970 174 p refs
(Contract NAS7-200)
(NASA-CR-123482; SD70-556-1-Vol-1) Avail: NTIS CSCL 14D

The methods and procedures used to perform nondestructive testing inspections of the Saturn S-2 liquid hydrogen and liquid oxygen tank weldments during fabrication and after proof testing are described to document special skills developed during the program. All post-test inspection requirements are outlined including radiographic inspections procedures. F.O.S.

N72-15472*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRODUCTION OF HOLLOW COMPONENTS FOR ROLLING ELEMENT BEARINGS BY DIFFUSION WELDING Patent Application
Thomas J. Moore, inventor (to NASA) Filed 9 Nov. 1971 19 p
(NASA-Case-LEW-11026-1; US-Patent-Appl-SN-190970) Avail: NTIS CSCL 13I

The production of a hollow rolling element for a bearing by diffusion welding of preformed components is discussed. Previous production methods using electron beam welding were unsatisfactory because of service cracking problems near the root of the weld. The diffusion welding process produces a lighter product and eliminates the cracking problem. NASA

N72-15473*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH SPEED HYBRID BEARING COMPRISING A FLUID BEARING AND A ROLLING BEARING CONNECTED IN SERIES Patent Application
William J. Anderson, inventor (to NASA) Filed 12 Nov. 1971 11 p
(NASA-Case-LEW-11152-1; US-Patent-Appl-SN-198379) Avail: NTIS CSCL 13I

A hybrid antifriction bearing with increased fatigue life for ultra high speed operation is described. The fluid film bearing and the rolling element bearing are connected in series. This enables both bearing elements to support a fraction of the rotational load of the high speed shaft. This configuration reduces the centrifugal forces and a resulting increase in fatigue life. NASA

N72-15474*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REMOTE CONTROL MANIPULATOR FOR ZERO GRAVITY ENVIRONMENT Patent Application
Frederic E. Wells, inventor (to NASA) Filed 18 Sep. 1970 12 p
(NASA-Case-MFS-14405; US-Patent-Appl-SN-73283) Avail: NTIS CSCL 13I

The design of a manipulator for handling objects in a zero gravity environment is discussed. The manipulator is used to move personnel, supplies, and equipment from place to place during activities inside and outside an orbiting space facility. The device consists of control cables inside and outside of tubular sections and has flexible joints with apertured pivoting disks for guiding the cables through the joints. NASA

N72-15475*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
UNIVERSAL ENVIRONMENT PACKAGE (UN-E-PAC) Patent Application
Graydon A. Phlieger, Jr., inventor (to NASA) Filed 16 Dec. 1970 12 p
(NASA-Case-KSC-10031; US-Patent-Appl-SN-98773) Avail: NTIS CSCL 13D

A housing is described which can be readily assembled for packaging equipment, such as electrical components and meters. It includes a pair of spaced end rings, each of which has an endless groove inner wall. A thin elongated shell is positioned within the groove and there are end plates adjacent to ridges on the opposite side of the rings. Bolts extend through the panels for drawing the panels flush against the ridges on the end ring and supporting panel boards within the housing. Thus, an airtight package or housing can be readily assembly. NASA

N72-15476*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
OXYGEN PRODUCTION METHOD AND APPARATUS Patent Application
David S. McKay, Everett K. Gibson, Jr., Patrick Butler, Jr., Norman H. Chaffee, Edward T. Chimenti, Alfred P. Sanders, Andre J. Meyer, Hoyt McBryar, T. R. Wellman, and P. Robin Brett, inventors (to NASA) Filed 5 Nov. 1970 16 p
(NASA-Case-MSC-12332-1; US-Patent-Appl-SN-87223) Avail: NTIS CSCL 13I

A process by which oxygen may be obtained from iron bearing mineral materials is examined. The process utilizes hydrogen reduction of the materials at elevated temperatures to produce water. The water is collected and used or electrolyzed to seprate the oxygen from hydrogen. The possible use of this method to obtain water from lunar soil is also discussed. E.H.W.

N72-15477# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
MACHINING AND GAGING INFORMATION Annual Index, 1970
A. M. Read and M. L. Shell 30 Jun. 1971 241 p refs
(Contract W-7405-eng-26)
(Y-SC-10) Avail: NTIS

This index contains a compilation of all information entries to the M.A.G.I.C. data base during Calendar Year 1970. The index consists of five sections: a title index, a key word index, an author index, a corporate author index, and a bibliographic section. Each bibliographic entry is arranged according to corporate author and includes a title, personal author, report designation, abstract, report availability, and key work descriptors. Author (NSA)

N72-15478# Japan Atomic Energy Research Inst., Tokai.
TURBINE GENERATOR: REFERENCES FOR THE JPDR OPERATION
K. Mori Mar. 1969 109 p refs In JAPANESE; ENGLISH summary
(JAERI-13509; JAERI-Memo-3509) Avail: AEC Depository Libraries

The manual turbine generator for JPDR operation reference was prepared to help the personnel in operation and maintenance of the JPDR. The components and other equipment of the turbine generator are described. The procedures of its operation, the associated problems, and the various tests and inspections on the turbine generator are explained. Theories and fundamentals concerning synchronous machines are given. NSA

N72-15479# Bendix Corp., Kansas City, Mo.
MACHINE COOLANT SELECTION AND MAINTENANCE MANUAL
V. A. Lyons Nov. 1970 83 p
(Contract AT(29-1)-613)
(BDX-613-205-Rev) Avail: NTIS

To select the fluid best suited to each machining operation requires an understanding of the basic functions of coolants and cutting compounds. This manual provides the rudiments of such knowledge by briefly discussing the principles of fluid selection and describing applicable procedures. No attempt has been made to provide exact formulas for the performance of a given operation; nor have undue limitations been imposed upon coolant application. Rather, this handbook should aid in selecting fluids for machining a variety of common materials. Author

N72-15480# Bendix Corp., Kansas City, Mo.
ELECTRICAL CONTACT SURFACE TREATMENT
G. A. Williams May 1971 38 p refs
(Contract AT(29-1)-613)
(BDX-613-402-S) Avail: NTIS

In phase 1, mechanical abrasion, chemical etching, and substitution of soft gold plating for subjective mechanical cleaning processes were evaluated as means of eliminating recurring contact resistance problems with miniature, low-current, sliding contacts. The favorable results obtained with soft gold plating permitted incorporation of process changes in production. In phase 2, the limitations on gold plating were investigated, as was the use of precious metal alloys for the contacts. Satisfactory contact resistance for these unsealed switches was achieved with all combinations of plating studied, and some information was obtained on the applicability of a nonprecious base material for contact usage. Author

N72-15481# Nagoya Univ. (Japan). Inst. of Plasma Physics.
HIGH SPEED ELECTRO-MAGNETIC VALVE
Riuichi Akiyama, Sunao Kawasaki, and Taijiro Uchida Mar. 1970 41 p refs In JAPANESE
(IPPJ-DT-17) Avail: AEC Depository Libraries

In plasma experiments, it is often required to fill a vacuum vessel with a known quantity of gas at some predetermined time. For this purpose, electromagnetically or mechanically driven high-speed valves are used in most cases. For valves of this type, fundamental analyses were performed to determine the relation between source voltage, stiffness of spring and static gas pressure, and valve characteristics of time interval (T) for which the valves open and gas volume. The driving circuit, gas flow measurement, and observation of T determined for the valve are reported. NSA

N72-15482# Royal Aircraft Establishment, Farnborough (England).
A POTENTIALLY CHEAP SELF-PRESSURIZED GAS BEARING ASSEMBLY
D. Faddy Nov. 1970 20 p refs
(RAE-TR-70227) Avail: NTIS

The manufacture of an asymmetric self-pressurized gas bearing assembly capable of supporting loads in any direction is described. The assembly consists of a single cone bearing opposed by flat thrust plates. The potential of the arrangement for cheap manufacture is discussed and some theoretical results are presented. These show that the plano-conical assembly compares favorably with conventional symmetric pairs of opposed conical bearings for radial stiffness and critical mass for journal stability. Author (ESRO)

N72-15483# Bundesanstalt fuer Materialpruefung, Berlin (West Germany).
DOCUMENTATION ON WEAR, FRICTION, AND LUBRICATION, VOLUME 7
1970 859 p refs In ENGLISH and GERMAN
Avail: NTIS HC $9.00/MF $0.95

The present continuing bibliography covers all types of publications (with the exception of patents) in the tribophysics field. Although covering recent material (to end of 1969) published since the last volume (1969), older material is included which has not been contained in previous volumes. ESRO

N72-15484# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
A PRELIMINARY INVESTIGATION OF JOINING METHODS FOR ALUMINUM-GRAPHITE COMPOSITES Report for 9 Sep. - 1 Dec. 1970
David M. Goddard, Roger T. Pepper, John W. Upp, and E. George Kendall 1 Aug. 1971 26 p refs
(Contract F04701-71-C-0172)
(AD-728636; TR-0172(9250-03)-1; SAMSO-TR-71-149) Avail: NTIS CSCL 13/8

Furnace brazing, furnace pressure welding, resistance spot welding, and gas tungsten-arc (GTA) welding all appear to have potential as joining processes for aluminum-graphite composites. At present, the most success has been achieved with furnace brazing. An important development in this process was the discovery that aluminum-silicon-magnesium brazing alloys would bond to the composites. Furnace welding will probably be most useful as a means of producing thick, multilayer composites. Spot welding produced bonding between composites and between a composite and a commercial aluminum alloy sheet. However, metal expulsion and composite crushing were common, and much work is needed to prevent these defects. GTA welding requires an automated process and close control over welding temperatures. Author (GRA)

N72-15485# Whirlpool Corp., St. Joseph, Mich. Life Support Systems Group.
A DEVICE FOR STORING AND DISPENSING BITE SIZE FOOD CUBES Technical Report, Feb. - Jun. 1969
Jerry L. Moore, John R. Watkin, and Norman G. Roth Brooks AFB, Tex. SAM Sep. 1971 31 p refs
(Contract F41609-69-C-0036; AF Proj. 7758)
(AD-731153; SAM-TR-71-33) Avail: NTIS CSCL 13/4

The report describes the fabrication and use of a 30-column

magazine device for storing bite-size food cubes in bulk quantity and for dispensing individual cubes. Illustrations and design drawings are included. The device was conceived and its feasibility for use aboard a space vehicle was documented in an earlier contract. Author (GRA)

N72-15486# Westinghouse Research Labs., Pittsburgh, Pa.
SOLID LUBRICATED BEARING TECHNOLOGY. PART 1: SOLID LUBRICATED HIGH SPEED BALL BEARING Final Report, 1 Jul. 1970 - 30 Jun. 1971
D. J. Boes Wright-Patterson AFB, Ohio AFAPL Aug. 1971 61 p refs
(Contract F33615-70-C-1736; AF Proj. 3048)
(AD-731163; AFAPL-TR-71-69-Pt-1) Avail: NTIS CSCL 13/9

The report describes efforts to develop improved self-contained, solid lubricated ball bearings capable of at least 25 hours operation at speeds approaching 60,000 rpm. The program encompasses a temperature range of -40F to 600F and a maximum load combination of 75 lb thrust/25 lb radial. The functional test portion of the program achieved a maximum life of 15 hours on a solid lubricated ball bearing operating at 30,000 rpm and a temperature of 200F. Author (GRA)

N72-15487# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF SLIDING FRICTION AND WEAR RESISTANCE OF GLASS FIBER REINFORCED PLASTIC
M. Zh. Dyushushe and V. F. Konyshev-Varnachev 21 Jul. 1971 20 p refs Transl. into ENGLISH from Neft. Naucan.-Issled. Inst. Ufimsk. (USSR), no. 21, 1968 p 117-130
(AF Proj. 7343)
(AD-731387; FTD-MT-24-116-71) Avail: NTIS CSCL 09/1

With respect to the magnitude of the friction coefficient, glass fiber reinforced plastic falls in the class of friction materials. The wear of glass fiber reinforced plastic is 4 times less than that of steel 45 during dry sliding friction over cast iron. During work in aqueous media the glass fiber reinforced plastic loses its wear resistance to a considerable degree. Surface-active additives which are commonly used for metals do not guarantee a reduction in wear of glass fpber reinforced plastic during friction in aqueous media. It is necessary to conduct a special study of antiwear additives which might be suitable for glass fiber reinforced plastic pipes. Author (GRA)

N72-15794# Associated Semiconductor Manufacturers, Ltd., Southampton (England).
RELIABILITY: ITS IMPLICATIONS IN DESIGN, MANUFACTURE, AND TESTING
R. Brewer *In* Soc. of Environ. Engr. Environ. Eng. 1970 9 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N72-15488*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC GASDYNAMIC LASERS
Robert L. McKenzie Dec. 1971 37 p refs
(NASA-TM-X-62099) Avail: NTIS CSCL 20E

Predictions from a numerical model of the vibrational relaxation of anharmonic diatomic oscillators in supersonic expansions are used to show the extent to which the small anharmonicity of gases like CO can cause significant overpopulations of upper vibrational states. When mixtures of CO and N2 are considered, radiative gain on many of the vibration-rotation transitions of CO is predicted. Experiments are described that qualitatively verify the predictions by demonstrating laser oscillation in CO-N2 expansions. The resulting CO-N2 gasdynamic laser displays performance characteristics that equal or exceed those of similar CO2 lasers. Author

N72-15489# Lockheed Missiles and Space Co., Palo Alto, Calif.
LASER LOCATION OF THE MOON
Iu. L. Kokurin [1971] 8 p Transl. into ENGLISH from Priroda (Moscow), no. 10, 1971 p 42-46
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The application of radar beams and radar reflectors for accurately located points on the surface of the moon is discussed. The use of lasers to refine the constants of the moon's orbital and rotational motion is described. The specifications for the radar transmitter and the radar reflector to accomplish the accurate mapping and orbit analysis are presented. Author

N72-15490# Lockheed Missiles and Space Co., Palo Alto, Calif.
SCREENING OF A SURFACE EVAPORATING UNDER THE EFFECT OF LASER RADIATION, WITH TEMPERATURE AND IONIZATION NONEQUILIBRIUM
I. V. Nemchinov and S. P. Popov [1971] 16 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekh. Fiz. (USSR), no. 5, 1971 p 35-45
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Computations were performed on the kinetics of laser-radiation heating of vapors evaporating from the surface of a solid, and indicate the existence of temperature and ionization nonequilibrium. It was shown that by taking account of the nonequilibrium, the critical value of the flux density is considerably reduced, corresponding to the beginning screening in a given time of its development for a given flux density, as compared with the equilibrium theories of the process. Certain physical processes are discussed which can, in addition to those taken into account, influence the origination of flare-ups. Author

N72-15491# Los Alamos Scientific Lab., N.Mex.
USE OF LASER REFLECTIONS TO CHARACTERIZE SURFACE MORPHOLOGY CHANGES
J. W. Tester and C. C. Herrick Jul. 1971 10 p refs
(Contract W-7405-eng-36)
(LA-4698) Avail: NTIS

The morphological changes occurring during vaporization from the (0001) (hexagonal cell basis) surface of arsenic were studied using optical and electron microscopy in conjunction with laser reflections and X-ray diffraction. Equilateral triangular and truncated equilateral triangular etch pits formed on the (0001) surface as the crystal was evaporated at temperatures of 270 to 290 deg C in a static vacuum. A constant angle of 12 deg (0001) plane and the etch-pit plane which was modelled as a stepped, high-index plane consisting of ledges and terraces. Author (NSA)

N72-15492# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
PROPERTIES OF AN ELECTRON SOURCE WITH LASER INDUCED ELECTRON EMISSION
G. Siller, E. Buchelt, and H. B. Schilling Apr. 1971 27 p refs
(IPP-0/7) Avail: AEC Depository Libraries

Measurements of the emittance of a pulsed electron source with laser-induced electron emission are described. The energy spread of the electrons in the pulse is evaluated by deflection in a static magnetic field. This source is to be used in an electron ring accelerator. Author (NSA)

N72-15493# Addis Translations International, Woodside, Calif.
PHOTOTROPIC FILM SHUTTER FOR PASSIVE Q SWITCHING OF A RUBY LASER

S. F. Sharlai Aug. 1971 6 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (Minsk), v. 13, no. 4, 1970 p 730-732 Sponsored by AEC Prepared for Sandia Labs., Albuquerque, N. Mex.
(SC-T-713055) Avail: NTIS

Phototropic films as passive shutters have certain advantages over solutions or glass plates in Q switching lasers with the aid of absorbing materials introduced into the resonator. They can be deposited on the end of the active rod, and the minimum resonator base can be obtained if a reflecting coating is deposited on the film. Inhomogeneous films, or a series of shutters with different transmissions, can be used to produce different Q switching conditions. Thin films can be used for selective Q switching of individual oscillation modes. Lastly, films are less expansive to produce than solutions or plates. Results of an experimental study indicate that film-forming materials are desirable which are more resistant to heat and light in order to optimize shutter parameters and increase their resistance to light damage. Dye molecules with suitable absorption bands can then be introduced into these materials. K.P.D.

N72-15494# Addis Translations International, Woodside, Calif.
LOW CONTROL VOLTAGE ELECTRO-OPTICAL SHUTTER FOR A RUBY LASER
B. B. Boiko, N. S. Petrov, V. A. Krivosheev, and V. E. Leparskii Aug. 1971 9 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (Minsk), v. 13, no. 5, 1970 p 812-815 Sponsored by AEC Prepared for Sandia Labs., Albuquerque, N. Mex.
(SC-T-713058) Avail: NTIS

An electro-optical shutter (Kerr cell) is described for a ruby laser which requires a working voltage that is lower than that in shutters incorporating quarter-ware elements, by a factor of about 2. The shutter incorporates a Pockels electro-optical element and a total reflection prism (Porro prism) whose edge is parallel to one of the principal directions of the electro-optical element induced by the field. In this optical system the phase shift occurring during total reflection between the components, which are respectively parallel and perpendicular to the plane of incidence on the face of the prism, and the phase shift produced by the electro-optical element, are algebraically added. This means that we can use an electro-optical element for the shutter which ensures a ray path difference of about lambda/8. Author

N72-15495# Addis Translations International, Woodside, Calif.
CONTROL OF LASER PULSE LENGTH WITH A KPD CRYSTAL
V. V. Arsenev, D. N. Klyshko, and R. Yu. Orlov Aug. 1971 4 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (Minsk), v. 13, no. 4, 1970 p 726-727 Prepared for Sandia Labs, Albuquerque, N.Mex. Sponsored by AEC
(SC-T-713057) Avail: NTIS

An experimental investigation is described to determine the feasibility of using a nonlinear loss mechanism for the control of a laser pulse length. With the proposed method, energy is transferred to the second harmonic by the use of a KDP crystal and resonator mirrors with a reflection coefficient of R = 1. One advantage of the method is the convenience of varying the nonlinear losses, and consequently the pulse length, by rotating the crystal about the sychronous position. D.L.G.

N72-15496# American Optical Co., Southbridge, Mass. Central Research Lab.
INTERMEDIATE PULSEWIDTH LASER SYSTEM Semiannual Technical Report, 1 Apr. - 30 Sep. 1966
Joseph W. Kantorski and C. Gilbert Young Feb. 1971 10 p refs
(Contract N00014-66-c-0005; ARPA Order 306; Proj. Defender)
(AD-731032; TR-582-2; SAR-2) Avail: NTIS CSCL 20/5

The report is the second in the series of semiannual technical reports on Contract N00014-66-C-0056. It begins discussion on phase two of the contract which consists of the design, construction and delivery of an intermediate pulsewidth laser system. Subjects covered include experiments in the use of a saturable absorber to decouple the laser amplifier rods and efforts leading to the design of a stacked plate polarizer. Author (GRA)

N72-15497# American Optical Co., Southbridge, Mass. Central Research Lab.
INTERMEDIATE PULSEWIDTH LASER SYSTEM Final Report, 1 Aug. 1965 - 30 Dec. 1970
Joseph W. Kantorski and C. Gilbert Young Mar. 1971 47 p refs See also Semiann. Tech. Rept. No. 5, AD-731035
(Contract N00014-66-C-0056; ARPA Order 306)
(AD-731036; TR-582-F) Avail: NTIS CSCL 20/5

The report delineates efforts expended in the design and construction of a glass laser system capable of providing high energy, spike-free output in square pulses of 1, 3, 10, 30 and 100 microsecond lengths. Output beamspread was on the order of 2 mrad or less. A general description of the laser system and its operation is presented first. Each of the major system sections (Laser Generator, Laser Preamplifier and Final Amplifier) are described in detail. Finally, typical output waveforms are shown. Author (GRA)

N72-15498# American Optical Co., Southbridge, Mass. Central Research Lab.
INTERMEDIATE PULSEWIDTH LASER SYSTEM-Semiannual Technical Report, 1 Apr. - 30 Sep. 1968
Joseph W. Kantorski and G. Gilbert Young Feb. 1971 16 p
(Contract N00014-66-C-0056; ARPA Order 306; Proj. Defender)
(AD-731035; TR-582-5; SATR-5) Avail: NTIS CSCL 20/5

This is the last in a series of semiannual technical reports on Contract N00014-66-C-0056. The report describes implementation of system modifications discussed previously. System performance studies were continued and threshold damage data were ascertained for Schott SF-4 optical glass. The device was delivered at the conclusion of the reporting period. Author (GRA)

N72-15499# American Optical Co., Southbridge, Mass. Central Research Lab.
INTERMEDIATE PULSEWIDTH LASER SYSTEM Semiannual Technical Report, 1 Oct. 1967 - 31 Mar. 1968
Joseph W. Kantorski and C. Gilbert Young Feb. 1971 21 p ref
(Contract N00014-66-C-0056; ARPA Order 306; Proj. Defender)
(AD-731034; TR-582-4; SATR-4) Avail: NTIS CSCL 20/5

The report is the fourth in the series of semiannual technical reports on Contract N00014-66-C-0056. Studies of the generators are continued. System performance with a preamplifier is considered as is the system stability. Polarization experiments were performed and damage thresholds for the various optical components were determined. Finally modifications to the laser system required as result of the above studies are described. Author (GRA)

N72-15500# American Optical Co., Southbridge, Mass. Central Research Lab.
INTERMEDIATE PULSEWIDTH LASER SYSTEM Semiannual Technical Report, 1 Apr. - 30 Sep. 1967
Joseph W. Kantorski and C. Gilbert Young Feb. 1971 10 p
(Contract N00014-66-C-0005; ARPA Order 306; Proj. Defender)
(AD-731033; TR-582-3; SATR-3) Avail: NTIS CSCL 20/5

The report continues discussion on the design, construction and delivery of an intermediate pulsewidth laser. The generator section is described, and preliminary system performance work was begun. Author (GRA)

N72-15501# Naval Research Lab., Washington, D.C.
APPLICATION OF A SCANNED LASER ACTIVE IMAGING SYSTEM TO ATMOSPHERIC AND UNDERWATER VIEWING ENVIRONMENTS Interim Report
Ronald W. Waynant 24 Aug. 1971 21 p refs
(RR Proj. 104-03-41)

(AD-731051; NRL-7287; NRL-N01-24) Avail: NTIS CSCL 17/8

A scanned-laser active imaging system employing a synchronously scanned image-dissector detector was analyzed from the standpoint of how much resolution would be available to an observer viewing a CRT display. Graphical results are given of the system performance in atmospheric and underwater environments as well as of the effects of laser power, wavelength, and the addition of image intensifiers to the receiving system. The novelty of the analysis is that it directly predicts the detection performance of the human observer when aided by a scanned-laser active imaging system. The performance of such a system compares favorably with range-gated imaging systems. Author (GRA)

N72-15502# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

ERBIUM LASER PROPAGATION IN SIMULATED ATMOSPHERES. 2: HIGH RESOLUTION MEASUREMENT METHOD

Kenneth O. White, E. Howard Holt, Stuart A. Schleusener, and Robert F. Calfee Fort Monmouth, N.J. ECOM Aug. 1971 35 p refs

(AD-731211; ECOM-5398) Avail: NTIS CSCL 20/5

The transmission of laser energy in a carbon dioxide medium was measured in the 1.54 micrometer spectral region with a nominal resolution of 0.02 nanometer. An erbium laser was used which has two output emission regions in the eye-safe realm of the spectrum; one region centered at 1.536 micrometers and 1.0 nanometer wide and the other centered at 1.543 micrometers and 2.0 nanometers wide. The CO2 sample was contained in a pressure and temperature controlled, 20-meter long, White cell. The monitor and transmitted laser pulses were detected by germanium photodiodes and recorded. A spectral scan over the laser output was obtained. A signal from the spectrometer was used to trigger the analyzer to accept only those laser spikes with wavelengths which fall within the preset wavelength window of the spectrometer. The spectrometer was scanned over the laser output and the transmission obtained as a function of wavelength. Data and theoretical calculations are presented for a 480-meter path length, a temperature of 30C, and a CO2 pressure of 660 torr. Author (GRA)

N72-15503# Informatics TISCO, Inc., Riverdale, Md.

BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS Interim Report, Jul. - Dec. 1970

Stuart G. Hibben 9 Jul. 1971 146 p refs

(Contract F44620-70-C-0081; ARPA Order 1622; AO Proj. 1622)

(AD-731242; AFOSR-71-2653TR; Rept-2) Avail: NTIS CSCL 20/5

This is the second issue intended to give a comprehensive listing of Soviet publications in laser technology for 1969-1970, and complements the first issue by covering all the non-periodic literature for this interval. This includes over 100 sources comprising institutional transactions, collections of articles, conference proceedings, and monographs dealing with laser developments. Also included is material from regular periodicals for July through December, 1970. Author (GRA)

N72-15504# Ballistic Research Labs., Aberdeen Proving Ground, Md.

VULNERABILITY OF LEAD SULFIDE DETECTORS TO LASER RADIATION

Millan D. Stoller Jun. 1971 20 p refs

(DA Proj. 1T0-61102-A-31-C)

(AD-730639; BRL-MR-2104) Avail: NTIS CSCL 09/1

Experimental results of an investigation on lead sulfide detectors show that their parameters remain unchanged when the level of irradiation generated by Q-switched laser pulses is less than 0.32 J/sq cm. Although the results given in this report cover data from a single detector, tests were made on several detectors under the same conditions with similar results. Incident intensities greater than 0.32 J/sq cm produced sufficient damage in the detector to impair its performance. Laboratory tests showed that, for incident radiation intensity greater than 1.63 J/sq cm, the responsivity and detectivity of the detector decreased appreciably. Author (GRA)

N72-15851*# TRW Systems Group, Redondo Beach, Calif.

APPLICATIONS OF HOLOGRAPHY TO HIGH FREQUENCY VIBRATIONS AND TRANSIENT RESPONSE

R. Aprahamian and D. A. Evensen *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 33-44 refs (See N72-15847 06-32)

(Contract NAS1-8361)

(NASA-CR-125413) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-15804# Institute TNO of Applied Physics, Delft (Netherlands).

APPLICATION OF LASERS FOR DEFORMATION AND VIBRATION ANALYSIS

H. J. Raterink *In* Soc. Of Environ. Engr. Environ. Eng. 1970 15 p (See N72-15791 06-31)

Avail: NTIS HC $6.00/MF $0.95

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N72-15505 National Lending Library for Science and Technology, Boston Spa (England).

KINETICS OF THE SOLUTION OF TiN IN Fe-Ni ALLOYS

V. I. Tomilov, Yu.-G. Gurevich, N. R. Frage, and E. P. Bulgakova 1971 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), no. 8, 1971 p 5-7

(NLL-M-21190-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A rotating sample method was used to measure the rate of solution of TiN in Fe-Ni melts. The analytical dependences found for the rates of solution were a function of nickel content at 1550 to 1630 C. It was found that TiN does not dissolve in Fe-11% Ni alloys when their Ti content is 0.2, 0.7, and about 2.4% at 1570, 1600, and 1630 C respectively. Author

N72-15506 National Lending Library for Science and Technology, Boston Spa (England).

SOME PHYSICO-MECHANICAL PROPERTIES OF COMPOSITE Ni-Al2O3 COATINGS

D. Ramanauskiene and J. Matulis 19 Nov. 1971 9 p refs Transl. into ENGLISH from Lietuvos TSR Mokslu Akad. Darbai, Ser. B (Vilnius), no. 1, 1971 p 107-114 In RUSSIAN and ENGLISH

(NLL-Trans-746-1060-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The physical and mechanical properties of cermet Ni coatings without subsequent chromium plating were studied. It was established that composite Ni-Al2O3 coatings, deposited from electrolytes of matte and bright nickel plating, are 1.5 to 2 times harder than the usual Ni coatings. The internal tensile stresses of the matte composite coatings were lower than those of the Ni coatings. There exists a direct correlation between the activity of the composte and its corrosion resistance. Almost all the investigated single layer Ni-Al2O3 coatings deposited directly on steel are less corrosion resistant than ordinary Ni coatings. Author

N72-15507 National Lending Library for Science and Technology, Boston Spa (England).

ELECTROLYSIS BORONIZATION OF SILICON AND NICKEL STEELS

L. S. Lyakhovich, E. P. Puchkov, and L. G. Vorochnin 19 Nov. 1971 6 p refs Transl. into ENGLISH from Vesti Akad. Navuk Belarusk. SSR, Ser. Fiz.-Tekh. Navuk (Minsk), no. 2, 1970 p 110-114 In RUSSIA and ENGLISH

(NLL-Trans-748-938-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An investigation of the effects of silicon and nickel alloys on the growth kinetics of boronized layers and their structures was conducted on average carbon steels. It was found that: Silicon decreased the depth of the boride layer, and nickel hardly affected or somewhat increased it. Silicon during boronization was forced into the surrounding boride zone and induced gamma to alpha transformation; nickel concentrated basically in the zone of the Fe2B boride. Both alloying elements practically did not affect the character of distribution and maximum concentration of carbon in the transition zone. Author

N72-15508 National Lending Library for Science and Technology, Boston Spa (England).

HEAT RESISTANCE OF TITANIUM SYSTEMS WITH EUTECTOID-FORMING ELEMENTS (Fe, Cr, Ni, Cu, Si) IN ANNEALED STATE

I. I. Kornilov, T. T. Nartova, and N. A. Zuikova 19 Nov. 1971 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 192, no. 5, 1970 p 1075-1078 In ENGLISH and RUSSIAN

(NLL-Trans-746-1002-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The results are presented for an investigation of the heat resistance of titanium alloys in the annealed state. The systems Ti-Si, Ti-Cu, Ti-Ni, Ti-CR, and Ti-Fe were considered. It was concluded that heat resistance of Ti-Si and Ti-Cu alloys is greater in the annealed state than in the forged state. The following law is correct for alloys of the Ti-Ni, Ti-Cr, and Ti-Fe systems with a very low solubility in alpha Ti. Alloys lying close to the boundary of solubility in these systems have a lesser heat resistance in the annealed state than in the forged state, but alloys lying in the heterogeneous area of the phase diagrams have a greater heat resistance in the annealed state. K.P.D.

N72-15509 National Lending Library for Science and Technology, Boston Spa (England).

EFFECT OF CHROMIUM AND NICKEL ON HEAT RESISTANCE OF Fe-Cp-Ni ALLOYS IN AIR

M. M. Osipov, A. I. Grigor'ev, and O. A. Bannykh 19 Nov. 1971 4 p refs Transl. into ENGLISH from Zashchita Metal. (Moscow), v. 7, no. 1, 1971 p 24-27 In ENGLISH and RUSSIAN

(NLL-Trans-746-1045-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The kinetics and phase composition of oxide films, forming in an atmosphere of air on the surface of Fe-Cr-Ni alloys, containing from 16 to 24 wt. percent Cr and from 30 to 45 wt. percent Ni at 850-1000 C and duration of testing of up to 1000 hours, were investigated. It was shown that the greatest oxidation resistance of the investigated alloys exists when the scale consists of the Ni(Fe, Cr)2O4 spinel and the Cr2O3 oxide. Author

N72-15510 National Lending Library for Science and Technology, Boston Spa (England).

UTILISATION AND IMPROVEMENT OF HIGH-CHROMIUM Ni-Cr ALLOYS

P. Hoch and M. Snablova 19 Nov. 1971 10 p refs Transl. into ENGLISH from Kovove Mater. (Bratislava), v. 8, no. 5, 1970 p 433-453 In ENGLISH and CZECH

(NLL-Trans-746-955-(9022-401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The effects of alloying elements on the heat resistance of Ni-Cr alloys are studied by observation of corrosion resistance. It is shown that cerium acts favorably since it neither determines the chromium content nor the number of phases in the alloy, and that calcium probably reacts with the cerium. Both effects can to a certain extent be expressed as a logarithmic function. The most effective alloying element seems to be yttrium. Besides acting as deoxidizers, cerium and yttrium can also change the structure of the Ni-Cr alloy. Author

N72-15511 National Lending Library for Science and Technology, Boston Spa (England).

THE ADSORPTION AND CATALYTIC PROPERTIES OF PLATINUM-OSMIUM ELECTRODE CATALYSTS IN 0.1 n SULPHURIC ACID SOLUTION

A. A. Sutyagina, I. N. Golyanitskaya, G. P. Khomchenko, and G. D. Vovchenko 19 Nov. 1971 5 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser 11: Khim (Moscow), v. 11, 1970 p 691-695 In ENGLISH and RUSSIAN

(NLL-Trans-746-931-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The catalytic activity of platinum-osmium electrode catalysts, of various chemical compostion, towards the reaction of nitromethane hydrogenation in 0.1 N H2S04 was investigated. Of particular concern, was the relation of the catalytic activity to the adsorption capacity of electrode catalysts with respect to hydrogen and the strength with which it is bonded to the catalyst surface. The study results indicate that an increase in the speed of catalytic hydrogenation takes place as the content of osmium in the catalysts increases. Also, that an increase in catalytic activity of low osmium Pt-Os alloys occurs with a simultaneous decrease in their hydrogen adsorption capacity. This is concluded as evidence for the absence of a direct relation between the rate of catalytic hydrogenation and the amount of hydrogen adsorbed by the catalyst. D.L.G.

N72-15512 National Lending Library for Science and Technology, Boston Spa (England).

ELECTRODEPOSITION OF COPPER-NICKEL ALLOY FROM PYROPHOSPHATE-AMMONIUM ELECTROLYTE

V. S. Galinker, P. V. Savenko, O. K. Kudra, and V. A. Laboda 19 Nov. 1971 5 p refs Transl. into ENGLISH from Ukr. Khim. Zh. (Kiev), v. 36, no. 7, 1970 p 735-739 In ENGLISH and RUSSIAN

(NLL-Trans-746-932-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effect of ammonium chloride on the deposition of a copper-nickel alloy from a pyrophosphate electrolyte was investigated. Preliminary tests were made for determination of the buffer properties of pyrophosphate nickel and copper one plating electrolyte with different ammonium chloride contents. The results indicate that, with the addition of ammonium chloride, the buffering power of the electrolyte increases, and that the greatest buffer properties are observed in an alkaline medium. Tests were then conducted to determine the effect of NH4C1 on the quantitative composition of the copper-nickel alloy. These results show that the presence of ammonium chloride in the pyrophosphate solution, with the same nickel and copper content, leads to an increase in the nickel content of the deposit on an average of 15%. In addition, the introduction of ammonium chloride considerably increases the cathodic efficiencies along the current and increases the scattering capacity of the electrolyte. D.L.G.

N72-15513 National Lending Library for Science and Technology, Boston Spa (England).

PHYSICO-MECHANICAL PROPERTIES OF COPPER-NICKEL ALLOY COATINGS, DEPOSITED FROM AMMONIUM ELECTROLYTES

V. S. Galinder, P. V. Savenko, O. K. Kudra, and V. A. Gorbatyuk 19 Nov. 1971 4 p refs Transl. into ENGLISH from Ukr. Khim. Zh. (Ukrainia), no. 4, 1970 p 360-362 In ENGLISH and RUSSIAN

(NLL-Trans-746-882-(9022.401)) Avail: Natl. Lending Library,

Boston Spa, Engl.: 1 NLL photocopy coupon

The results are presented of a study to determine the physico-mechanical properties of copper-nickel alloy coatings, deposited from ammonium electrolytes, and include data on the microhardness and microstructure, internal stresses and porosity of deposits, and phase composition of these alloys. Measurements of the stationary potential and a construction of its dependence on the composition of the Cu-Ni alloy indicate an almost direct-linear dependence of the potential on the composition of the alloy. The investigation of microhardness and microstructure show that alloys obtained at low current densities possess the most perfect structure. Data on the determination of internal stresses in deposits of the alloy indicate that Cu-Ni Monel type alloys have decreased internal stresses in comparison with Ni, obtained from the same electrolytes. The curves of these dependencies show that an increase in the Cu content in the deposit leads to a considerable decrease in their internal stresses. It was also established that almost non-porous Cu-Ni alloys are deposited from ammonium electrolytes with a deposit thickness of 10 microns. D.L.G.

N72-15514 National Lending Library for Science and Technology, Boston Spa (England).

THE INFLUENCE OF ANTIPHASE BOUNDARIES ON THE MAGNETIC PROPERTIES OF FERROMAGNETIC MATERIALS

A. I. Mitsek and S. S. Semyannikov Dec. 1971 5 p refs Transl. into ENGLISH from Ukr. Fix. Zh. (Kiev), v. 14, no. 10, 1969 p 1657-1660

(NLL-RTS-6812) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.50 or 2 NLL photocopy coupons

An analytical study was made of the magnetic reversal of ferromagnetic materials as a phase transition. In addition to obtaining the technical magnetization curve of these materials, the study was also concerned with determining the role of defects in the crystalline and magnetic structure on the magnetic behavior. A system of antiphase boundaries of atomic ordering in ordered alloys was used to examine the interaction of the ferromagnetic domain boundaries with two-dimensional defects. A series of calculations is presented which were made to determine: (1) the thermodynamic potential of the system, (2) the surface interaction, (3) the magnetization curve, and (4) the interaction energy of the ferromagnetic domain boundaries and the antiphase boundaries of atomic ordering. D.L.G.

N72-15515 National Lending Library for Science and Technology, Boston Spa (England).

EFFECT OF INHIBITORS ON POLARIZATION AND LEVELLING ACTION OF NICKEL-PLATING ELECTROLYTES

Kruglikov. S. S. and L. M. Antipova 19 Nov. 1971 5 p refs Transl. into ENGLISH from Zashchita Metal. (Moscow), no. 1, 1971 p 46-49 In ENGLISH and RUSSIAN

(NLL-Trans-746-985-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The brightening and levelling action of nickel-plating electrolytes is induced by the introduction into them of a predetermined concentration of certain additions called inhibitors of electrodeposition. The dependence of the levelling action of the addition on its concentration have a maximum whose existence is linked with the mechanism of levelling. The position, height and width of the maximum area under identical conditions are determined by the nature of the addition. Levelling additions exist, for which the curve of levelling concentration has a minimum as well as a maximum, sometimes situated in the anti-levelling area. One of the methods of rapid determination of the optimum concentration range of the additions is based on the determination of the potential displacement of the rotating disc electrode during a change in the rotation rate. Author

N72-15516 National Lending Library for Science and Technology, Boston Spa (England).

OPTIMISATION OF THE STRUCTURE AND PROPERTIES OF HIGH STRENGTH AUSTENITIC STEELS

Yu. K. Kovneristyi and V. M. Blinov 1971 2 p Transl. into ENGLISH from Stal (Moscow), no. 8 p 753

(NLL-M-21216-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The structures of a wide range of austenitic steels (Fe-Mn, Fe-Mn-Ni, Fe-Mn-Cr, and other systems) were investigated and their strength properties studied to find the best compositions for structural service conditions with high loadings. Radiographic and electron-microscopic investigation of fine foils and fractography provided an explanation of the change in strength properties (yield point, fracture toughness, and fatigue strength) in relation to the type of alloy and nature of the dispersion hardening during aging. The optimum parameters for mildly dispersion hardened particles (in particular 150-300A size) and the most rational relationships between the basic alloying elements forming the austenite matrix were established. From the data given by electron microscope analysis of fine foils it was calculated that the yield point of the steel must be around 80-100kg/mm2. Author

N72-15517*# TRW Equipment Labs., Cleveland, Ohio.

GENERATION OF LONG TIME CREEP DATA ON REFRACTORY ALLOYS AT ELEVATED TEMPERATURES

Semiannual Report, 8 May - 8 Nov. 1970

K. D. Sheffler 16 Nov. 1970 92 p refs

(Contract NAS3-13469)

(NASA-CR-72871; TRW-ER-7506; SAR-1) Avail: NTIS CSCL 11F

Creep tests were conducted on two tantalum alloys (ASTAR 811C and T-111 alloy), on a molybdenum alloy (TZM), and on CVD tungsten. The T-111 alloy 1% creep life data have been subjected to Manson's station function analysis, and the progress on this analysis is described. In another test program, the behavior of T-111 alloy with continuously varying temperatures and stresses has been studied. The results indicated that the previously described analysis predicts the observed creep behavior with reasonable accuracy. In addition to the T-111 test program, conventional 1% creep life data have been obtained for ASTAR 811C alloy. Previously observed effects of heat treatment on the creep strength of this material have been discussed and a model involving carbide strengthening primarily at the grain boundaries, rather than in a classical dispersion hardening mechanism, has been proposed to explain the observed results. Author

N72-15518*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.

THE VARESTRAINT TEST FOR REFRACTORY METALS, TASK 2 Final Report

G. G. Lessmann and R. E. Gold Nov. 1970 42 p refs

(Contract NAS3-11827)

(NASA-CR-72828; WANL-RR(VVV)-002) Avail: NTIS CSCL 11F

The principles of the Varestraint test were applied to the evaluation of refractory metal alloys. This required development of a special test apparatus employing a modest specimen size for improved economy and compatible with the high purity inert atmosphere required for welding these alloys. Minimum specimen size is desirable because of the high cost of these alloys and also to permit timely testing of limited production developmental alloys. The Varestraint apparatus satisfies these requirements by providing a timely and economic test for hot crack sensitivity. This test can be used both for alloy development and production surveillance. The test apparatus was designed for use in vacuum purged dry boxes and is completely compatible with high purity inert atmosphere. Augmented strain can be varied continuously from 1/4% thru 4%. In addition to varying the augmented strain, the primary Varestraint variable, the effect on hot cracking of varying other weld parameters such as unit weld length heat input have also been studied. Test reproducibility, in terms of bending or strain rate, was demonstrated using high speed photography. Author

N72-15519*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NICKEL ALUMINIDE COATED LOW ALLOY STAINLESS STEEL Patent Application

Salvatore J. Grisaffe and Ernest W. Klechka, inventors (to NASA) Filed 18 Oct. 1971 11 p

(NASA-Case-LEW-11267-1; US-Patent-Appl-SN-190316) Avail: NTIS CSCL 11F

Low alloy austenitic stainless steel is protected from oxidative corrosion and erosion at high temperatures in the presence of exhaust gases from internal combustion engines by flame-spraying a layer of an alloy of 80% nickel and 20% chromium onto the steel base, and thereafter converting the layer to an intermetallic chromium containing nickel aluminide coating by low temperature aluminum cementation process. A cementation pack comprising 96 percent aluminum oxide, 2 percent aluminum, 1 percent sodium chloride, and 1 percent ammonium bifluoride is placed on the nickel-chromium layer in an inert atmosphere for a period between 4 hours and 24 hours at 1400 F to 1600 F to form an intermetallic chromium containing nickel aluminide coating containing 40 to 60 atomic percent aluminum. NASA

N72-15520*# Techtran Corp., Glen Burnie, Md.

STRUCTURAL CHANGES IN CHROMIUM DURING CREEP

G. Y. Kozyrskiy, V. K. Sulzhenko, and S. M. Braun Washington NASA Jan. 1972 6 p refs Transl. into ENGLISH from the book "Fizicheskaya Priroda Plasticheskoy Deformatsii i Razrusheniya Metallov" Kiev, Naukova Dumka Press, 1969 p 77-80

(Contract NASw-2037)

(NASA-TT-F-14083) Avail: NTIS CSCL 11F

An X-ray study of structural changes occurring during creep tests was carried out at 900 C in air on chromium specimens previously annealed at 1100 C in vacuum. One of the specimens was annealed in addition at 1400 C in argon. It was found that the change in the crystalline disorientation during creep is determined by the applied stress and generally terminates during the stage of transient creep. Author

N72-15521*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CYCLIC CREEP AND FATIGUE OF TD-NiCr (THORIA-DISPERSION-STRENGTHENED NICKEL-CHROMIUM), TD-Ni, AND NiCr SHEET AT 1200 C

Marvin H. Hirschberg, David A. Spera, and Stanley J. Klima Washington Feb. 1972 29 p refs

(NASA-TN-D-6649; E-6601) Avail: NTIS CSCL 11F

The resistance of thin TD-NiCr sheet to cyclic deformation was compared with that of TD-Ni and a conventional nickel-chromium alloy. Strains were determined by a calibration technique which combines room-temperature strain gage and deflection measurements with high-temperature deflection measurements. Analyses of the cyclic tests using measured tensile and creep-rupture data indicated that the TD-NiCr and NiCr alloy specimens failed by a cyclic creep mechanism. The TD-Ni specimens, on the other hand, failed by a fatigue mechanism. Author

N72-15522# Argonne National Lab., Ill.

VOID FORMATION IN PROTON AND NICKEL IRRADIATED TYPE 304 STAINLESS STEEL

A. Taylor and S. G. McDonald Jun. 1971 23 p refs Presented at the Intern. Conf. on Radiation Induced Voids in Metals, Albany, N. Y., 9-11 Jun. 1971

(Conf-710601-10) Avail: NTIS

The swelling of several samples of type 304 stainless steel bombarded with 1.25-MeV protons or 3.5 to 4.0-MeV Ni(+) ions has been studied using quantitative stereo electron microscopy. The swelling of proton bombarded samples is significantly greater than the Ni(+) bombarded samples and there was no indication of any saturation with dosage. Void formation occurred by sequential nucleation and growth. Author (NSA)

N72-15523# Battelle Memorial Inst., Richland, Wash.

VOID FORMATION IN NEUTRON IRRADIATED MOLYBDENUM AND RHENIUM

J. L. Brimhall, G. L. Kulcinski, and H. E. Kissinger [1971] 12 p refs Presented at the Intern. Conf. on Defects in Refractory Metals, Mol, Belgium

(BNWL-SA-3920; CONF-710905-2) Avail: NTIS

The effects of temperature on neutron-induced void formation in TZM, Mo, and Re at 600 to 1450 C were investigated. Using additional data from other studies, the temperature dependence of volume change at 50 to 1450 C was determined. Results of the investigation showed that the void size increases and the density decreases with increase in irradiation temperature for both Mo and Re. NSA

N72-15524# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

HIGH TEMPERATURE HEAVY ION BOMBARDMENT OF Mo, Nb, AND TZM

G. L. Kulcinski and J. L. Brimhall [1971] 10 p refs Presented at the Intern. Conf. on Defects in Refractory Metals, Mol, Belgium

(BNWL-SA-3922; CONF-710905-1) Avail: NTIS

Results of studies of heavy ion bombardment of Nb, Mo, and TZM show that voids were formed in all three metals after 800, 900, and 1000 C irradiation. No voids were found in Nb and Mo that were irradiated at 650 and 700 C; only dislocation loops and segments were found. There was also some evidence for the formation of precipitation along with voids in the TZM alloys during 800 and 900 C bombardments. The average void size in the metal was shown to increase with increasing irradiation temperature in all the metals and the number density was reduced. NSA

N72-15525# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

COMPATIBILITY OF FERRIC STEELS WITH LIQUID SODIUM AT HIGH TEMPERATURES

J. Sannier, O. Konovaltschikoff, D. Leclercq, and R. Darras 1971 16 p refs Presented at Intern. Conf. on the Effects of Environ. on Mater. Properties in Nucl. Sys., London, 1-2 Jul. 1971

(CEA-CONF-1787; Conf-710713-1) Avail: AEC Depository Libraries

The long term behavior, in liquid sodium at temperatures between 475 and 650 C, of various ferritic steels containing 2.25 or 9% chromium is compared with that of mild or austenitic steels. At 475 C, stabilized or unstabilized ferritic steels are practically unaffected, whereas mild steels are heavily decarburized. At 650 C, unstabilized 2.25% chromium steel shows a considerable decarburization; this phenomenon does not affect 9% chromium steel, which presents a weight loss lower than 0.5 mg. per square centimeter after 6000 hours, similar to that of austenitic steels. Author (NSA)

N72-15526# Ceskoslovenska Akademie Ved, Rez.

COURSE OF PHASE TRANSFORMATION AND GRAIN REFINEMENT IN LOW PERCENTAGE ALLOYS OF URANIUM WITH IRON, ALUMINUN, AND SILICON

E. Kaderabek, I. Haubelt, and V. Kraus Mar. 1971 43 p refs In CZECH; ENGLISH summary

(UJV-2526-M) Avail: AEC Depository Libraries

The effects of cooling rate on transformation characteristics and grain refinement in dilute binary and polycomponent alloys of uranium with iron, aluminum, and silicon were investigated. Transformation diagrams were determined for continuous cooling in the cooling rate range from 10 to 300 C/sec. The alpha-beta transformations of the alloys are dependent on cooling rate and proceed by mechanisms such as diffusion, bainitic transformation, and martensitic transformation. The highest grain refinement has occurred in the region of bainitic transformation and during martensitic transformation by water quenching. It is shown that the effect of alloying additions (Fe, Al, Si) on transformation kinetics and on grain refinement is not equivalent and fully

additive. Among the binary alloys, the greatest transformation hysteresis was observed in U-Si alloys, whereas the highest grain refinement was in U-Fe alloys. The results show that fluctuation of the content of alloying additions in certain intervals should not substantially influence the structure of U-Fe-Al and U-Fe-Al-Si alloys after thermal treatment. Author (NSA)

N72-15527# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
ELECTRICAL PROPERTIES OF AMORPHOUS (Pd(60-x) Pt(x) Ni40)75-P25
B. Y. Boucher Sep. 1971 7 p refs
(Contract AT(04-3)-822)
(CALT-822-35; AEC-R/D-30) Avail: NTIS

The electrical properties of amorphous ternary alloys of Pd-Ni-P and Pt-Ni-P containing 25 at.% of phosphorus are examined. The preparation of alloys, the quenching methods and the X-ray diffraction technique used for checking the amorphous state of each specimen are described. The electrical resistivity and its variation with temperature was measured from 1.2 K or 4 K to room temperature by the standard four points probe technique. In some cases, measurements were made only between 77 K and room temperature. The curves of resistivity versus temperature were similar to those reported for ternary Pd-Ni-P alloys and had a nearly linear portion between about 100 K and room temperature. Author

N72-15528# Battelle Memorial Inst., Columbus, Ohio.
MECHANICAL PROPERTIES OF SHOCK STRENGTHENED AUSTENITIC STAINLESS STEEL
M. Kangilaski and A. A. Bauer Jun. 1971 40 p refs
(Contract W-7405-eng-92)
(BMI-1909) Avail: NTIS

Shocking was found to significantly increase the yield strength and proportional limit, moderately increase the ultimate strength and generally decrease the ductility, although an intermediate increase in ductility with increasing shocking pressure was noted in material shock strengthened by means of a flyer plate. The magnitude of the change in tensile properties increased with shocking pressure (80 to 320 kbar) and held for all testing temperatures. The microstructure of shock strengthened austenitic stainless steel exhibited fine striations when examined by light microscopy, while a high dislocation density and mechanical twins were identified by transmission electron microscopy. Annealing of the shock-strengthened material for 1 hour at 900C resulted in the disappearance of the defect structure and the changes in mechanical properties. Shock strengthened reduced the minimum creep rate of Type 316 stainless steel by a factor of about 100 and that of Type 304 stainless steel by a factor of about 1000 at 650 C for stress ranging from 25,000 to 35,000 psi. Author (NSA)

N72-15529# National Aerospace Lab., Amsterdam (Netherlands).
TITANIUM ALLOYS FOR AEROSPACE
R. J. H. Wanhill May 1971 30 p refs Revised Sponsored by the Neth. Agency for Aerospace Programs
(NLR-TR-71003-U-Rev) Avail: NTIS

The metallurgy and heat treatment of titanium alloys and their development, availability and applications in the aerospace industry are reviewed. Problems suitable for materials research are outlined. Classified tables of alloys are given in an appendix; the alloys are classified into four strength ranges. Within each range competitive alloys are compared for a variety of properties. ESRO

N72-15530# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Werkstoff-Forschung.
AN ANALYSIS OF CUMULATIVE DAMAGE BY MEANS OF BIHARMONIC LOADING
H. Nowack (Ph.D. Thesis - Aachen Univ.) 1971 118 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-23) Avail: NTIS; DFVLR Porz: 32 DM

The accumulation of fatigue damage caused by consecutive load cycles with varying amplitudes and mean stresses is investigated systematically by applying biharmonic loading to notched AlCuMg2 specimens. The stress-strain behaviour of the material at the notch root is experimentally determined at the beginning of fatigue life. For this purpose a special strain pick up was developed. The measured stress-strain curves are analysed and no significant correlation is found between the plastic strain range or the hysteresis energy at the notch root and the fatigue life. The crack propagation is a function of the deformations measured very close to the tip of the crack. An analytical expression for crack propagation is suggested. Several often used cumulative damage theories are also discussed. Author (ESRO)

N72-15531# Rolls-Royce, Ltd., Leavesden (England). Small Engines Div.
EVALUATION OF ANTI-FRETTING COMPOUNDS FOR THE PREVENTION OF FRETTING FATIGUE OF ALUMINUM ALLOYS AT TEMPERATURES UP TO 150 C
W. J. Harris London Min. of Defence Jul. 1971 23 p
(D-MAT-174) Avail: NTIS

Fretting fatigue researches were carried out to investigate the fretting problems of aluminum alloys, operating up to 150 C. A simple practical scheme, providing full protection, follows: (1) parent aluminum alloy given a protective chromate filming treatment, and (2) anti-fret scheme superposed, consisting of air-cured isocyanate-epoxy resin medium loaded with molybdenum disulfide 2. Attempts to incorporate corrosion inhibition with chromates in the anti-fret film led to unacceptable depreciation of fatigue strength. A molybdenum disulfide 2 loaded epoxy resin scheme cured at 150 C and solid shims of carbon fiber-resin mats also eliminate fretting effects but would be less attractive in practical use. Author (ESRO)

N72-15532# Army Foreign Science and Technology Center, Charlottesville, Va.
EXPERIMENTAL RESEARCH INTO PATTERNS OF CARBON STEEL DEFORMATION UNDER COMBINATION OF STRESSES AT LOW TEMPERATURES
G. S. Pisarenko, A. A. Lebedev, and V. P. Lamashevskii 10 Jul. 1971 16 p refs Transl. into ENGLISH from Probl. Proch. Mashinostr. (Moscow), no. 5, 1969
(AD-728737; FSTC-HT-23-938-71) Avail: NTIS CSCL 11/6

Consideration is given to the effects of low temperatures on metal deformation and fracture during combination of stresses. A first attempt is made at experimental proof of two basic hypotheses -- the stress deviator is proportional to the deformation deviator and the intensity of stress is the deformation function, completely determined and not depending upon any stress condition -- at a variety of low temperatures. GRA

N72-15533# Army Foreign Science and Technology Center, Charlottesville, Va.
THE ABSORPTION OF ENERGY BY ALLOYS UNDER PLASTIC COMPRESSION
N. V. Tyzhonva 5 Oct. 1970 14 p refs Transl. into ENGLISH from Zh. Tekhn. Fiz. (Leningrad), v. 16, no. 12
(AD-731053; FSTC-HT-23-777-71) Avail: NTIS CSCL 11/6

Energy absorption under plastic deformation is shown to be greater for alloys than for pure metals. This is explained by the presence of lattice distortions in the alloy; evidently the energy is absorbed in the deformation of third order residual stresses. GRA

N72-15534# Martin Marietta Corp., Denver, Colo.
ENHANCEMENT OF THE CREEP RESISTANCE OF METALS Final Report, 15 Sep. 1970 - 15 Sep. 1971
I. R. Kramer and N. Balasubramanian Sep. 1971 45 p refs
(Contract N00019-71-C-0143)

(AD-730524; MCR-71-259) Avail: NTIS CSCL 11/6

Creep data are reported for three materials titanium (6Al-4V), Haynes 188, and 321 steel. In all three cases, a specimen which had been prestressed below the proportional limit and whose surface layer had been eliminated creeps at much lower rates compared to untreated ones. The ratio, R, of creep rates in untreated and treated specimens decreases with stress and reaches a value of 1 at the proportional limit where the surface layer is completely reformed in the treated specimen. Ratios of 4 in titanium (6Al-4V) at 600F, 14 in 321 steel at 1200F, and 14 in Haynes 188 at 1600F are reported at the lowest stresses investigated. The improvements are independent of method of prestressing (in tension or in bending or by shot-peening) and removal of surface layer stress (room temperature stress relaxation or high temperature relaxation, chem-milling). A model is proposed to explain the mechanism by which such large improvements are obtained. This model considers a specimen as a composite of surface and core with workhardening and recovery occurring in both parts. Author (GRA)

N72-15535# North American Rockwell Corp., Los Angeles, Calif.

RELAXATION PROCESSES IN METASTABLE BETA TITANIUM ALLOYS

A. Sommer, S. Motokura (Calif. Univ., Los Angeles), K. Ono (Calif. Univ., Los Angeles), and O. Buck Sep. 1971 37 p refs

(Contract N00014-67-C-0439; NR Proj. 031-718)

(AD-731021; NA-71-897; TR-5) Avail: NTIS CSCL 11/6

Extensive observations have been made on an internal friction peak in a series of metastable beta Ti-Mo and -V alloys. The peak was observed at two frequencies (10 to the 4th c/s and 10 to the 7th c/s) in temperature ranges of 120K to 140K and 153K to 210K respectively depending on alloy compositions as well as frequency. In both alloy systems, the peak strength passed through a maximum with increasing alloy content at or near the upper compositional bound for athermal omega formation. In both alloy systems, the peak persisted at compositions well above the upper compositional bound for athermal omega formation although it was greatly diminished in height. The peak's strength was severely reduced by annealing in the thermal omega precipitation temperature range. The results of the work will be compared to the properties of a similar internal friction peak reported earlier in Zr base alloys. Author (GRA)

N72-15536# Army Materials and Mechanics Research Center, Watertown, Mass.

CALCULATION OF ELASTIC PROPERTIES OF ANISOTROPIC SHEETS AND RODS OF CUBIC AND HEXAGONAL CRYSTALS

Anthony G. Martin Jul. 1971 24 p refs

(DA Proj. 1T0-62105-A-328)

(AD-731202; AMMRC-TR-71-15) Avail: NTIS CSCL 11/6

Expressions are derived which relate the directional variation of Young's modulus and Poisson's ratio in sheets and rods (also shear modulus in rods) with strong, simple textures of cubic or hexagonal crystals. The expressions are based on assumptions of pure single-phase composition, uniform stress, small grain size, and idealized grain orientation. When randomized, they are consistent with those obtained by Reuss' method for averaging moduli in randomly oriented grains. Author (GRA)

N72-15537# Naval Research Lab., Washington, D.C.

FINITE ELEMENT ANALYSIS OF NOTCHED TENSILE SPECIMENS IN PLANE STRESS Final Report

Christopher A. Griffis 10 Sep. 1971 38 p refs

(RR Proj. 007-01-46-5431)

(AD-731372; NRL-7278; NRL-M01-24) Avail: NTIS CSCL 11/6

A computer program using the finite-element method has been written to describe the elastic-plastic behavior of notched bars under plane-stress tensile loading. At load levels below general yield, notch-root strain measurements made on bluntly-notched (K(t) = 3.06), 2024-T3 aluminum sheet specimens are within 8 percent of the values predicted by the numerical analysis. Experimental and analytical results indicate that the Neuber relationship for pure shear is not applicable to plane-stress tensile loading for the notch geometry and strain-hardening behavior encountered in the present study. Author (GRA)

N72-15538# Naval Civil Engineering Lab., Port Hueneme, Calif.

PROTECTION OF DSRV SEAL SEAT SURFACES EXPOSED TO CYCLIC PRESSURE IN SEAWATER Technical Note, Nov. 1968 - Mar. 1970

James F. Jenkins and Fred M. Reinhart Jun. 1971 17 p

(NCEL Proj. 52-003)

(AD-731356; NCEL-TN-1160) Avail: NTIS CSCL 11/6

The efficacy of two coating systems in preventing corrosion of seal seats similar to those used for the through-hull electrical penetrators on the Deep Submergence Rescue Vehicle (DSRV) was evaluated under simulated DSRV operating conditions. A very thin (.0002 in. to .0003 in.) wash primer reduced corrosion of the seal seats for a short period and a thicker (.0023 in. to .0025 in.) coating system prevented seal seat corrosion for 183 simulated service cycles in pressurized seawater. Author (GRA)

N72-15539# Iowa Univ., Iowa City. Dept. of Mechanics and Hydraulics.

MATERIAL INSTABILITIES IN THE EXPERIMENTAL STUDY OF THE PLASTIC COMPRESSIBILITY OF SOME IMPORTANT METALS

K. C. Valanis and Han-Chin Wu Aug. 1971 53 p refs

(Grant AF-AFOSR-1916-70; AF Proj. 9749)

(AD-730613; M/H-1.03; AFOSR-71-2546TR) Avail: NTIS CSCL 11/6

The hypothesis of plastic incompressibility, which is pivotal in the development of the classical theory of plasticity was tested by means of a series of simple tension tests on aluminum, copper and low carbon steel. The experimental measurements show conclusively that these metals are plastically compressible, the compressibility increasing with straining in the plastic region. A new phenomenon, termed lateral instability, was also observed, consisting of an abrupt plastic flow in the transverse direction either immediately preceding or immediately following yield in the longitudinal direction, during a simple tension test on low carbon steel. To a less pronounced extent such a phenomenon was also observed in the case of commercially pure aluminum. Author (GRA)

N72-15800# Metaalinstituut TNO, Delft (Netherlands). Metal Finishing and Corrosion Dept.

ATMOSPHERIC CORROSION OF METALS

J. W. Boon *In* Soc. of Environ. Engr. Environ. Eng. 1970 19 p (See N72-15791 06-31)

Avail: NTIS HC $6.00/MF $0.95

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N72-15540# Hamburg Univ. (West Germany).

STUDIES OF THE DEPENDENCE OF CHROMIUM OXIDE MAGNETIC PROPERTIES ON PARTICLE SIZE Ph.D. Thesis [UNTERSUCHUNGEN ZUR TEILCHENGROESSENABHAENGIGKEIT DER MAGNETISCHEN EIGENSCHAFTEN VON CHROMOXID]

Lothar Pintschovius 1971 105 p refs In GERMAN

Avail: NTIS

The effects of chromium oxide particle sizes on their

magnetic properties were studied by measuring the temperature functions in electron spin resonance absorption intensities. Results show that Neel temperature variations are caused by lattice defect concentrations in the particle structures and not by particle sizes. Transl. by G.G.

N72-15541*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DIMENSIONAL-STABILITY STUDIES OF CANDIDATE SPACE-TELESCOPE MIRROR-SUBSTRATE MATERIALS
John M. Jerke and Robert J. Platt, Jr. Washington Jan. 1972 24 p refs
(NASA-TN-D-6626; L-7727) Avail: NTIS CSCL 11D

The effects of aging, vacuum exposure, and thermal cycling on the dimensional stability of mirror-substrate materials, fused silica, Cer-Vit, Kanigen-coated beryllium, polycrystalline silicon, and U.L.E. fused silica were investigated. A multiple-beam interferometer was used to determine nonrecoverable surface-shape changes of the 12.7-cm-diameter mirrors with substrates of these materials. Thermal cycling and aging in vacuum produced the largest changes, but only a few were as large as 1/30 wavelength, where the wavelength was 632.8 nm. Author

N72-15542*# TRW Systems Group, Redondo Beach, Calif.
TEST AND EVALUATION OF APOLLO 14 COMPOSITE CASTING DEMONSTRATION SPECIMENS 6, 9, AND 12, PHASE 1 Final Report
J. L. Reger Sep. 1971 90 p refs
(Contract NAS8-27085)
(NASA-CR-61367) Avail: NTIS CSCL 11F

Flight and control specimens 6, 9, and 12 from the Apollo 14 composite casting demonstration were evaluated with respect to the degree of dispersion achieved for mixtures of immiscible materials under one-gravity and low gravity environments. The flight and control capsules 6, 9, and 12 contained paraffin and sodium acetate; paraffin, sodium acetate and argon; and paraffin, sodium acetate and 100 micrometer diameter tungsten microspheres, respectively. The evaluation and documentation utilized photographic and microstructure examinations, density measurements, and droplet size and distribution determinations. In addition, theoretical analyses were performed in order to aid in the understanding of the fluid behavior of the specimens during processing and subsequent solidification. A comparison of evaluated data with the theoretical analyses reveals that although the immiscible materials were uniquely dispersed in a low gravity environment, nonuniform dispersions were obtained primarily due to insufficient initial mixing and an essentially unidirectional thermal gradient during cooldown. Author

N72-15543*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POLYIMIDE RESIN-FIBERGLASS CLOTH LAMINATES FOR PRINTED CIRCUIT BOARDS Patent Application
Bobby W. Kennedy, inventor (to NASA) Filed 10 Sep. 1970 13 p
(NASA-Case-MFS-20408; US-Patent-Appl-SN-71048) Avail: NTIS CSCL 11E

Laminated insulating boards for use as printed circuit board base members are described. Conductive circuit paths are applied to the board in a predetermined pattern, and electronic components are mounted to form electronic assemblies for general use. The laminated board is made up of multiple plies of fiberglass cloth impregnated with polyimide resin and formed by heating a stacked array of resin-impregnated cloth layers under pressure. NASA

N72-15544*# Rensselaer Polytechnic Inst., Troy, N.Y. Materials Div.
RETRACTION OF COLD DRAWN POLYETHYLENE: THE INFLUENCE OF LAMELLAR THICKENESS AND DENSITY
James R. Falender and David Hansen Aug. 1971 40 p refs
(Grant NGL-33-018-003)
(NASA-CR-125401) Avail: NTIS CSCL 11D

The role of crystal morphology in the retraction of oriented, linear polyethylene was studied utilizing samples crystallized under conditions controlled to vary, separately, lamellar crystal thickness and density. Samples were oriented in a simple shear deformation to a strain of 4.0 prior to measuring retraction tendency in creep and relaxation type tests. Characterizations of specimens were made using wide and small angle X-ray techniques. The specific morphological variations were chosen to test the hypothesis that a long range elastic restoring force can originate in conjunction with deformation of lamellar crystals and the consequent increase in lamellar crystal surface area and surface free energy. The results support this hypothesis. Author

N72-15545*# Mississippi State Univ., State College. Dept. of Electrical Engineering.
COMPUTER SIMULATION OF IMPURITY DIFFUSION IN SILICON, PART 1 Interim Report
J. D. Gassaway and J. A. Etheridge 12 Jan. 1972 89 p refs
(Contract NAS8-26749)
(NASA-CR-123495) Avail: NTIS CSCL 11D

The elementary classical models for idealized diffusion conditions are described, and the principles are then used in developing more realistic models. The practical models require some type of numerical analysis. The numerical techniques are outlined and details concerning their implementation are given. Some results are presented which were obtained with the computer programs implementing the numerical techniques with implicit and explicit methods. Special problems of impurity-rich interlayers forming between an oxide and silicon are considered. A set of computed curves for sheet resistance, junction depth, and oxide thickness for different diffusion schedules is included. Author

N72-15546*# Avco Corp., Lowell, Mass. Systems Div.
TIME AND TEMPERATURE DEPENDENT MODULUS OF PYRRONE AND POLYIMIDE MOLDINGS
L. L. Lander Washington NASA Jan. 1972 79 p refs
(Contract NAS1-8495)
(NASA-CR-1946) Avail: NTIS CSCL 11D

A method is presented by which the modulus obtained from a stress relaxation test can be used to estimate the modulus which would be obtained from a sonic vibration test. The method was applied to stress relaxation, sonic vibration, and high speed stress-strain data which was obtained on a flexible epoxy. The modulus as measured by the three test methods was identical for identical test times, and a change of test temperature was equivalent to a shift in the logarithmic time scale. An estimate was then made of the dynamic modulus of moldings of two Pyrrones and two polyimides, using stress relaxation data and the method of analysis which was developed for the epoxy. Over the common temperature range (350 to 500 K) in which data from both types of tests were available, the estimated dynamic modulus value differed by only a few percent from the measured value. As a result, it is concluded that, over the 500 to 700 K temperature range, the estimated dynamic modulus values are accurate. Author

N72-15547# Sanders Nuclear Corp., Nashua, N.H.
DEVELOPMENT OF THE SIREN CAPSULE Final Report
R. W. Anderson, W. F. Bierds, and H. E. Rexford Dec. 1970 54 p refs
(Contract AT(29-2)-2708)
(SNC-2708-3) Avail: NTIS

An evaluation of ZrO2-ZrO2 composite liner materials and development of hot fabrication methods were performed as part of the development of the SIREN capsule, a nonmetallic encapsulation system for radioisotopic heat sources. Of the ZrO2 materials available for liner applications, the most promising materials were selected for evaluation as ZrO2-ZrO2 composite liners. Test ZrO2-ZrO2 composite liners were evaluated for gas permeability, thermal stability, and post-impact containment of simulated fuel cores (ThO2-Mo cermet). Methods were developed

for filament winding ZrO2 yarn and graphite yarn over hot fuel cores (thermal fuel simulants). As part of the development of methods for hot infiltration of the graphite impact structure, process parameters were defined for the deposition of pyrolytic carbon. Author (NSA)

N72-15548# Bendix Corp., Kansas City, Mo.
MOISTURE CONTENT STUDY OF Y-3333 CELLULAR SILICONE Interim Report
G. W. Edman, IV Jul. 1971 20 p
(Contract AT(29-1)-613)
(BDX-613-386) Avail: NTIS

Y-3333 cellular silicone was subjected to a series of tests to determine its affinity for moisture in an effort to characterize drying and packaging requirements for parts fabricated from this material. The percent-by-weight moisture content of the Y-3333 was measured at equilibrium for various relative humidities and at various exposure times for a single relative humidity. Analysis of the data indicates that the material has a rather high affinity for moisture, the magnitude of which varies directly with the relative humidity of the environment. The material tends to stabilize with its environment so rapidly that control of the moisture content to a level below the equilibrium condition would seem to be impossible. Author

N72-15549# Bendix Corp., Kansas City, Mo.
DEVELOPMENT OF ELASTOMER CUSHIONS Quarterly Report, 1971 - 1972
G. W. Edman, IV Jul. 1971 13 p
(Contract AT(29-1)-613)
(BDX-613-458) Avail: NTIS

The following development studies are reported: effects of chemical constituents on physical properties; quantification of frictional shear characteristics; effect of time delay at intermediate processing stages; determination of molding pressure requirements; and effects of material elongation on load versus deflection properties. Each testing program is described, and the data accumulated to date are presented. But there are not sufficient data at present to warrant conclusions for any of the studies except the material elongation study which was completed this quarter. Analysis of the data from that study indicates that material elongation up to 5 percent does not have a measurable effect on the load versus deflection properties of the material. Author

N72-15550# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
MAGNETISM IN AMORPHOUS Fe-Pd-P ALLOYS
T. E. Sharon and C. C. Tsuei Aug. 1971 59 p refs
(Contract AT(04-3)-822)
(CALT-822-34; AEC-R/D-29) Avail: NTIS

Amorphous alloys were prepared by rapid quenching from the liquid state. The Mossbauer effect in Fe-57 was used to study the magnetic properties. The hyperfine field distribution was determined as a function of composition and temperature. The electronic state of Fe in these alloys remains essentially constant throughout the composition range, and the Pd d level is filled by electron transfer from phosphorus. The variation of the magnetic transition temperature with composition was also determined. The Mossbauer effect results confirm the existence of weakly coupled Fe atoms in all the alloys. These atoms reside in low effective fields and can participate in the spin-flip scattering process which produces a Kondo effect (resistivity minimum). The large critical concentration observed is also an indication that the spin correlations are greatly reduced. Author

N72-15551# Explosives Research and Development Establishment, Waltham Abbey (England).
RELATIONSHIPS BETWEEN POLYURETHANE ELASTOMER STRUCTURE AND AGING PROPERTIES PART 1: DEGREE OF CROSSLINKING
B. E. Brokenbrow, F. Sims, and J. Wright Aug. 1970 28 p refs
(ERDE-TR-39) Avail: NTIS

The effects of crosslink density on the aging properties of polyurethane elastomers have been studied using a series of typical polyester and polyether urethanes of M sub c values (average molecular weight between crosslinks) between 2,500 and infinity. While the unaged polyester urethane elastomers showed the highest strengths, the polyether urethane elastomers showed superior hydrolytic stability. An optimum balance between mechanical properties and the resistance to hydrolysis and standard test fluid appeared to be achieved with a relatively high degree of crosslinking ie M sub c values of less than 5,000. Author ESRO

N72-15552# California Univ., San Diego. Dept. of the Aerospace and Mechanical Engineering Sciences.
OPTIMIZATION IN A CLASS OF RELAXATION MODULI FOR LINEARLY VISCOELASTIC MATERIALS
J. B. Schipmoelder and W. Nachbar May 1971 52 p refs
(Grant AF-AFOSR-2062-71; AF Proj. 9782-01)
(AD-731114; TR-1; AFOSR-71-1911TR; Rept-61102F; Rept-681307) Avail: NTIS CSCL 20/12

Optimization of relaxation functions E for linearly viscoelastic materials is considered for a one-dimensional problem which is suggested by desirable performance of a lap-seat belt in automobiles. An optimum relaxation modulus E bar of the belt is sought which would permit the speed v sub 0 of the vehicle prior to an abrupt impact to have maximum value v bar sub 0 under certain constraints imposed for the safety of the user of the belt. A class c star of cost functions is defined on the deceleration u that is imposed by the belt on the user. For given c belongs to c star, the post-impact constraints imposed are (1) the maximum displacement of the body must not exceed a critical displacement, (2) the forward speed of the body, if and when at the critical displacement, should not exceed a prescribed maximal value v sub f, and (3) the values of c during the motion of the body must not exceed an allowed maximal value c max. Optimization of E is sought in a defined class of relaxation moduli, constructed so as to limit the rubbery moduli to values not exceeding a specified, relatively low value, thus contributing to the comfort of the passenger during non-crash conditions. It is shown in the paper, for each c belongs to c star, that constraints (1) and (2) are both active if the E bar material is employed at the maximal speed v bar sub 0. In addition, it is shown that constraint (3) is active for any c of a certain subset of c star. Author (GRA)

N72-15553# Naval Weapons Center, China Lake, Calif.
STUDY OF THE EFFECT OF CHAR FORMATION ON THE SHEAR STRENGTH OF A NYLON-PHENOLIC ABLATOR
Warren K. Smith and W. Richard Compton Jun. 1971 66 p refs
(AD-730703; NWC-TP-5204) Avail: NTIS CSCL 11/9

A combined theoretical/experimental investigation of the importance of aerodynamic shear in the char removal from nylon-phenolic ablators is presented. The equations and numerical techniques used in a computer program developed to predict the one-dimensional behavior of charring ablators is also presented. In addition, a description of the experimental techniques employed in the measurement of char shear strength is given. It is shown that the shear strength of a 50% nylon-50% phenolic ablator during or after charring is an order-of-magnitude higher than the aerodynamic shear stresses developed during hypersonic flight at low altitudes. Author (GRA)

N72-15554# Air Force Systems Command, Wright-Patterson AFB, Ohio.
HEAT RESISTANT COATINGS: SELECTED ARTICLES
27 Aug. 1971 37 p refs Transl. into ENGLISH from Proceedings of 4th All-Union Conf. on Heat Resistant Coatings (Leningrad), 27-31 May 1968 p 295-301, 316-323, 464-471
(Contract F33657-71-D-0057; AF Proj. 7343)
(AD-731385; FTD-HC-23-748-71) Avail: NTIS CSCL 11/3

Contents: The effect of small additions of oxygen on the process of producing coatings in thermal decomposition of molybdenum carbonyl; The effect of molybdenum carbonyl films on the mechanical properties of molybdenum and Niobium; On the effect of titanium coatings on the plasticity of molybdenum.
Author (GRA)

N72-15555# Interand Corp., Rockville, Md.
WHISKER REINFORCEMENT OF PIEZOELECTRIC TRANSDUCER CERAMICS Quarterly Report, 1 Jan. - 30 Jun. 1971
Kenneth E. Feith 26 Aug. 1971 48 p refs
(Contract N00014-70-C-0182; IW Proj. 70-26)
(AD-730484; QR-6) Avail: NTIS CSCL 11/4

The principle program objective is to effect an increase in the intrinsic dynamic strength of piezoelectric ceramic materials, commonly used in Navy sonar projectors and hydrophones, through the introduction of alpha alumina (sapphire) whiskers into the ceramic matrix. Recent investigations have been concerned with the effect of material blending techniques and manufacturing procedures on the ultimate dynamic strength and piezoelectric properties of 3% by weight whisker reinforced samples of Types I (hard), II (soft), and III (very hard) lead zirconate titanate materials. Test results show increases of 25 to 500% in dynamic strength, improved high temperature stability, reduced dielectric loss, very considerable improvement in dielectric permittivity aging characteristics, and slightly reduced electromechanical coupling and linear behavior to higher drive levels than that obtainable in nonwhisker reinforced counterparts.
Author (GRA)

N72-15898*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NEW FIRE RETARDANT FOAMS AND INTUMESCENTS
John A. Parker *In* Univ. of S. Calif. Fireproofing and Safety Symp. Proc. 27 May 1972 p 55-108 refs (See N72-15894 06-33)
Avail: NTIS CSCL 11D

N72-15899*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
OTHER NASA-DEVELOPED MATERIALS AND SOME INDUSTRIAL APPLICATIONS
Matthew I. Radnofsky *In* Univ. of S. Calif. Fireproofing and Safety Symp. Proc. 27 May 1971 p 109-129 (See N72-15894 06-33)
Avail: NTIS CSCL 11D

N72-15900*# Thermal Systems, Inc., St. Louis, Mo.
FIRE RETARDANCY USING APPLIED MATERIALS
Rubin Feldman *In* Univ. of S. Calif. Fireproofing and Safety Symp. Proc. 27 May 1971 p 131-162 refs (See N72-15894 06-33)
Avail: NTIS CSCL 13L

N72-15901*# Koppers Co., Inc., Pittsburgh, Pa.
FIRE RETARDANCY WITH STRUCTURAL MATERIALS
Richard E. Gardner *In* Univ. of S. Calif. Fireproofing and Safety Symp. Proc. 27 May 1971 p 163-172 (See N72-15894 06-33)
Avail: NTIS CSCL 11D

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N72-15556# Technische Univ., Berlin (West Germany).
STRUCTURE AND SEQUENTIAL ORGANIZATION OF OPTIMAL SUPPLY BY THEORY OF FINITE GRAPHS Ph.D. Thesis [AUFBAU- UND ABLAUFORGANISATORISCHE LAGEROPTIMIERUNG MITTELS DER THEORIE ENDLICHER GRAPHEN]
Eberhard Schult 1970 62 p refs In GERMAN
Avail: NTIS

An optimal organizational algorithm is formulated that considers transportation methods which also include unsteady transportation sequences. Specific demands of supply organizations are expressed in points (supply locations) and line systems (transportation routes) on organizational diagrams. An organizational sequencing model with or without capacity limitations is used to optimize transportation coordination between various internal production regions at minimal costs.
Transl. by G.G.

N72-15557*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OBJECTIVE ESTIMATES BASED ON EXPERIMENTAL DATA AND INITIAL AND FINAL KNOWLEDGE
Burt M. Rosenbaum Washington Jan. 1972 42 p refs
(NASA-TN-D-6639; E-6382) Avail: NTIS CSCL 12A

An extension of the method of Jaynes, whereby least biased probability estimates are obtained, permits such estimates to be made which account for experimental data on hand as well as prior and posterior knowledge. These estimates can be made for both discrete and continuous sample spaces. The method allows a simple interpretation of Laplace's two rules: the principle of insufficient reason and the rule of succession. Several examples are analyzed by way of illustration. Author

N72-15558*# Ohio State Univ., Columbus. Electroscience Lab.
THE CALCULATION OF THE EIGENVALUES AND EIGENFUNCTIONS OF MATHIEU'S EQUATION
D. B. Hodge Washington NASA Jan. 1972 15 p refs
(Grant NGL-36-008-138)
(NASA-CR-1937; Rept-2902-4) Avail: NTIS CSCL 12A

The eigenfunctions of Mathieu's equation are expanded in trigonometric series, and the resulting eigenvalue problem is cast in matrix form. This matrix is found to be a symmetric, triagonal matrix, and the eigenvalues are computed using the bisection method. The eigenfunction expansion coefficients are obtained by the standard recursion method. This computational technique for the eignvalues and eigenfunctions of Mathieu's equation is both rapid and accurate. Author

N72-15559*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A METHOD FOR NONLINEAR EXPONENTIAL REGRESSION ANALYSIS
Bobby G. Junkin 29 Oct. 1971 92 p refs
(NASA-TM-X-64633) Avail: NTIS CSCL 12A

A computer-oriented technique is presented for performing a nonlinear exponential regression analysis on decay-type experimental data. The technique involves the least squares procedure wherein the nonlinear problem is linearized by expansion in a Taylor series. A linear curve fitting procedure for determining the initial nominal estimates for the unknown exponential model parameters is included as an integral part of the technique. A correction matrix was derived and then applied to the nominal estimate to produce an improved set of model parameters. The solution cycle is repeated until some predetermined criterion is satisfied. Author

N72-15560*# Israel Program for Scientific Translations, Ltd., Jerusalem.
NEW VARIATIONAL METHODS IN FLIGHT DYNAMICS
V. F Krotov, V. Z. Bukreev, and V. I. Gurman 1971 216 p refs Transl. into ENGLISH of the publ. "Novye Metody Variatsionnogo Ischisleniya v Dinamike Poleta" Moscow, Mashiostr., 1969

(NASA-TT-F-657; TT-70-50186; UDC-629.7.015:519.3) Avail: NTIS CSCL 12A

Variational methods for the optimization of motion of aircraft and other objects are considered. The elements of variational method theory are discussed first. A number of specific methods and the synthesis of optimal control are presented. The structure and analysis of degenerate and sliding controls are also treated. Solutions to a number of problems of powered flight dynamics are presented, including vertical rocket ascent in a vacuum, rocket dynamics in a homogeneous field in a vacuum, and powered aircraft flight. A detailed construction is given of an approximate synthesis of optimal aircraft control on the ascent section. Author

N72-15561# RAND Corp., Santa Monica, Calif.

FURTHER RESULTS ON THE ERRORS IN THE VARIABLES PROBLEM

Richard V. Cooper and Joseph P. Newhouse Oct. 1971 14 p (P-4715) Avail: NTIS

The effects of measurement errors in one or more explanatory variables upon the asymptotic bias of the coefficients and the t tests are considered. A simple regression model is presented with one explanatory variable. Then a model with two explanatory variables is presented. Finally, the n-variable model is expanded by partitioning. It was found that if one variable is subject to measurement error, its coefficient and t statistic are asymptotically biased toward zero, even though the sign of the asymptotic bias of its standard error cannot be determined. If more than one explanatory variable is subject to measurement error, the sign of the bias in all coefficients and t statistics cannot be determined a priori. Author

N72-15562*# Brown Univ., Providence, R.I. Center for Dynamical Systems.

THE TOPOLOGY OF THE REGULARIZED INTEGRAL SURFACES OF THE 3-BODY PROBLEM

Robert Easton 1971 46 p refs
(Grant NGL-40-002-015)
(NASA-CR-125425) Avail: NTIS CSCL 12A

Momentum, angular momentum, and energy of integral surfaces in the planar three-body problem are considered. The end points of orbits which cross an isolating block are identified. It is shown that this identification has a unique extension to an identification which pairs the end points of orbits entering the block and which end in a binary collision with the end points of orbits leaving the block and which come from a binary collision. The problem of regularization is that of showing that the identification of the end points of crossing orbits has a continuous, unique extension. The regularized phase space for the three-body problem was obtained, as were regularized integral surfaces for the problem on which the three-body equations of motion induce flows. Finally the topology of these surfaces is described. K.P.D.

N72-15563# Rome Univ. (Italy).

ON ELEMENTARY SOLUTIONS OF THE SCHRODINGER EQUATION FOR SOME TIME DEPENDENT INTERACTIONS

L. Pietronero and E. Salusti 22 Apr. 1971 7 p refs
(Nota-Interna-314) Avail: NTIS

Time dependent Hamiltonians and their elementary solutions are described and applied to nuclear interactions.

ESRO

N72-15564# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

CONFORMAL MAPPING OF THE OUTSIDE OF THE CIRCLE WITH UNIT RADIUS TO THE OUTSIDE OF A SINGLE COHERENT DOMAIN. PART 1: POLYGONS [UEBER DIE KONFORME ABBILDUNG DES AEUSSEREN DES EINHEITSKREISES AUF DAS AEUSSERE EINES EINFACH ZUSAMMENHAENGENDER GEBIETES. TEIL 1: POLYGONE]

D. Nikolitsch Bonn Bundeswehramt 1971 33 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-71-22-Pt-1) Avail: NTIS; Bundeswehramt: 25 DM

Conformal mapping methods are applied to boundary value problems; its numerical treatment is reviewed. Symmetric polygons are considered, and all problems arising from determination of polygonal parameters are treated. Author (ESRO)

N72-15565# California Univ., Los Angeles. School of Engineering and Applied Science.

CLOSED LOOP FORMULATIONS OF OPTIMAL CONTROL PROBLEMS FOR MINIMUM SENSITIVITY

Robert Nelson Crane Jun. 1971 96 p refs
(Contracts F04701-70-C-0240; AF-AFOSR-0699-67; AF Proj. 9749)
(AD-728330; UCLA-ENG-7135; AFOSR-71-2268TR) Avail: NTIS CSCL 12/1

A new formulation of the trajectory sensitivity problem is developed to reduce the effects of modeling errors in optimal control systems. Necessary conditions for minimum sensitivity are obtained from a measurable quasiconvex family of direction fields. These techniques are applicable to a large class of nonlinear systems that could not be handled previously by standard sensitivity methods. The principal result is a complete theory for the practical design of minimum sensitive linear feed back compensators. Sufficient conditions are developed from new theorems relating conjugate points to the positive definiteness and controllability of the accessory minimum problem. The advantages of the minimum sensitive compensator relative to least square parameter estimators are discussed. An example illustrates the improved sensitivity characteristics of the compensator as compared to model following and regulating controls. Author (GRA)

N72-15566# Texas Univ., Austin. Center for Cybernetic Studies.

AN ALGORITHM FOR SEPARABLE PIECEWISE CONVEX PROGRAMMING PROBLEMS

Richard M. Soland Aug. 1971 35 p refs
(Contracts N00014-67-A-0126-0008;
N00014-67-A-0126-0009; NR Proj. 047-021)
(AD-730755; CS-60) Avail: NTIS CSCL 12/2

A branch and bound algorithm is presented to solve mathematical programming problems of the form: Find x = (x sub 1,...,x sub n) to minimize the summation of phi(sub io)(x sub i) subject to x belongs to G, l < or = x < or = L, and the summation of phi(sub ij)(x sub i) < or = 0, j = 1,...,m. With 1 = (1 sub 1,...,1 sub n) and L = (L sub 1,...,L sub n), each phi(sub ij) is assumed to be lower semicontinuous and piecewise convex on the finite interval (l sub i)(L sub i). The G is assumed to be a closed convex set. The algorithm solves a finite sequence of convex programming problems; these correspond to successive partitions of the set C = the set (x/l < or = x < or = L) on the basis of the piecewise convexity of the problem functions phi(sub i). Computational considerations are discussed, and an illustrative example is presented. Author (GRA)

N72-15567# Ballistic Research Labs., Aberdeen Proving Ground, Md.

A BIBLIOGRAPHY FOR THE NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

John H. Giese Jul. 1971 519 p refs
(RDT/E Proj. 1T0-61102-A-14-B)
(AD-730662; BRL-MR-2114) Avail: NTIS HC $6.00/MF $0.95 CSCL 12/1

A list of 5867 references to the numerical solution of partial differential equations has been compiled. References to reviews in seven abstracting journals have been given, and a primitive index has been prepared. Author (GRA)

N72-15855 Bacharach Instrument Co., Mountain View, Calif. Johnson-Williams Div.
PREDICTABLE SHOCK PULSE BY MODIFIED FOURIER TRANSFORMS
Charles W. Young *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt 7 Dec. 1969 p 93-98 ref (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N72-15568 National Lending Library for Science and Technology, Boston Spa (England).
PROPERTIES OF WIND IN BUILT-UP AREAS
B. Holmer 10 Oct. 1971 10 p refs Transl. into ENGLISH from Byggmaestaren (Sweden), v. 12, 1970 p 8-11
(NLL-Lib-Comm-1604-(5196)) Avail: 1 NLL photocopy coupon

Wind properties in built-up urban areas were investigated for planning good ventilation, planning acceptable wind environments, predicting snow accumulation, and designing buildings. Average wind speeds, gustiness, the connection between wind velocity and length of measuring interval were studied for various types of urban areas. It was found that the low mean wind velocity within an enclosed building group involves the risk of unsatisfactory ventilation. With an unsuitable location of buildings, strengthening of winds can occur which results in an unsatisfactory living environment. Vegetation reduces wind forces and has a cleansing effect on the air. Groups of buildings seem to give rise to relatively stronger gusts than those occuring at free open spaces. Author

N72-15569# Secretariat General a l'Aviation Civile, Paris (France).
DYNAMIC STUDY OF LAYERS FROM 0 TO 100 m AT ROISSY, FRANCE [ETUDE DYNAMIQUE DE LA COUCHE 0-100 M (SITE DE ROISSY-EN-FRANCE)]
J. Saissac, C. Mercusot, M. Perrier, G. Beyneix, and J. P. Roux Aug. 1971 54 p refs In FRENCH
(MN-Mono-81) Avail: NTIS

An aerological and climatological survey of the near-surface atmospheric layer was made in connection with plans to build an aerodrome about a dozen kilometers east of Le Bourget, France. Average wind profiles (direction and velocity) and temperature profile data were considered in relation to vertical stability. These data will be used in a study of air movements in order to pinpoint times of mean maxima and most significant levels and to establish vertical separation in longitudinal turbulence. The apparatus used is described and data reduction discussed. Results of the study are presented in graph form.
Transl. by K.P.D.

N72-15570# Bureau of Meteorology, Melbourne (Australia).
STATISTICS ON THE SPATIAL AND TEMPORAL VARIATION OF WIND IN THE AUSTRALIAN REGION Meteorological Summary
J. N. McRae [1969] 106 p refs
Avail: NTIS

Tabulations, by seasons and for the total period June 1957 to May 1961, are presented of the stretch vector and between component correlation coefficients for winds at various stations with those at four parent stations ranging in latitude from about 21 S to 38 S. Statistics on the temporal changes of wind for lags of from, at one station, 6 to 48 hours and at another station 12 to 48 hours are also presented as well as statistics relating to 24-hour lags at eight other stations. Statistics on the variations of wind in the vertical are also presented for 23 Australian stations. The statistics refer to selected levels from the surface to 55,000 ft and relate in general to stations equipped with electronic wind finders. Author

N72-15571*# Translation Consultants, Ltd., Arlington, Va.
VARIOUS VERTICAL SAMPLING DEVICES FOR AEROSOLS Ph.D. Thesis
A. Julian Washington NASA Jan. 1972 61 p refs Transl. into ENGLISH from Etude des Differents Dispositifs de Prelevement en Altitude des Aerosols, Toulouse Univ., France, 1970 86 p
(Contract NASw-2038)
(NASA-TT-F-14084) Avail: NTIS CSCL 04B

The vertical distribution in the atmosphere of the long lived radioactive elements (Be-7, P-32, Sr-90, Pb-210, and Po-210) and the stable elements (Na, Br, Fe, P, Mn and Cl) was studied. The connection with certain atmospheric physics problems was envisaged, and an investigation was made of various sampling devices. The interest in these particular elements and the various procedures already used, are discussed. The experimental work carried out on the filters is described, and the mathematical equations for calculating the rates of flow are solved. The experimental developments, performances obtained, and calibration procedures are presented. Author

N72-15572# Hosei Univ., Tokyo (Japan). Dept. of Geography.
SELECTED BIBLIOGRAPHY ON WATER BALANCE OF MONSOON ASIA, 2
Iwao Tsuchiya (Meteorol. Res. Inst.) 1971 42 p refs
(Climatol-Notes-8) Avail: NTIS

The bibliography includes entries of reference books and climatological atlases as well as articles, covering the area encompassed by India, Indonesia, Japan, and China. There are a total of 446 references. N.E.N.

N72-15573 Finnish Meteorological Inst., Helsinki.
CLIMATOLOGICAL DATA, 1970
1971 90 p refs In ENGLISH and FINNISH
(Rept-551.506.1(480)) Avail: NTIS

Daily observations from seven stations in Finland, and monthly and annual summaries from 143 stations, are presented in tabular form. The daily recordings, from the synoptic station at Kuusamo and six airport weather stations, include air temperatures, maximum and minimum temperatures for the day precipitation data, depth of snow, air pressures, and relative humidity. Author

N72-15574# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Lab.
FOG DROPLET SIZES AT THE PANAMA CANAL
L. H. Ruhnke May 1971 20 p refs
(NOAA-TR-ERL-209-APCL-22) Avail: SOD $0.30 as 0317-0037

Data of fog droplet spectra and condensation nuclei concentrations were taken during December 1970 at the Panama Canal. Mass median diameter of fog droplets was 21 microns. Nuclei concentrations varied between 500 and 5000 particles per square centmeter. A high frequency of persistent meteorological conditions for radiation fog, low wind, and a thin fog layer make this area a good testing ground for warm fog modification concepts. Author

N72-15575# National Oceanic and Atmospheric Administration, Washington, D.C.
FEDERAL PLAN FOR METEOROLOGICAL DATA FROM SATELLITES
May 1971 63 p
(NOAA-FCM-71-5) Avail: NTIS

The participating agencies, the Departments of Commerce (DOC) and Defense (DOD) and the National Aeronautics and

Space Administration (NASA), have developed a coordinated statement of common requirements for meteorological data from satellites, a concept of operations for the national system, a description of the present and the planned operational systems, and a proposal for potential applications of satellites to meteorology. This plan does not cover non-meteorological sensors, for instance, for the space environment, which may be carried on otherwise primarily meteorological satellite vehicles. Where plans for such sensors exist, they have been mentioned briefly to complete the description of the sapcecraft. Author

N72-15576# IIT Research Inst., Chicago, Ill.
SCAVENGING STUDY OF SNOW AND ICE CRYSTALS Quarterly Progress Report, 1 May - 31 Jul. 1971
Sudesh K. Sood Aug. 1971 24 p refs
(Contract AT(11-1)-578)
(IITRI-C-6105-16) Avail: NTIS

Experimental work on aerosol generation was resumed. A vaporization-condensation aerosol generator was assembled, and a number of fluorescent materials were examined to determine the feasibility of using fluorescent aerosols during snow scavenging experiments. Author (NSA)

N72-15577# IIT Research Inst., Chicago, Ill.
SCAVENGING STUDY OF SNOW AND ICE CRYSTALS Final Report, 1 Nov. 1969 - 31 Jan. 1971
Sudesh K. Sood 10 Feb. 1971 72 p refs
(Contract AT(11-1)-578; IITRI Proj. C6105)
(IITRI-C-6105-14) Avail: NTIS

Scavenging efficiency of naturally precipitating snow and ice crystals was determined for submicron polystyrene latex and sodium chloride aerosols. The effect of crystal habit, dimensions, and particle size on scavenging efficiency was established. Experimental results show the scavenging efficiency to be a function of both the crystal and particle diameter. In addition, data on SO2 scavenging by snow and ice crystals is also included. Experimental work on capture of aerosol particles by growing ice crystals was also initiated. Experimental data obtained so far show that the number of particles captured by a growing ice crystal is proportional to the mass of the crystal.
Author (NSA)

N72-15578# Sandia Labs., Albuquerque, N.Mex.
VAPOR TRAIL EXPERIMENTS OVER KAUAI, HAWAII, AND TONOPAH, NEVADA
Lawrence B. Smith Aug. 1971 78 p refs Sponsored by AEC
(SC-RR-710008-Rev) Avail: NTIS

Rocket experiments were conducted, during which chemical trails were ejected at altitudes above 80 km. Wind profile data were obtained for altitudes of 80 to 170 km. Descriptions of the rocket systems, camera stations, and data reduction are given. Analysis of wind observations and comparison with results at other locations are provided. A study is included for a series of four observations taken during a 6-hour interval, showing a downward phase progression during the night and a clockwise rotation of the wind vector with altitude. These characteristics corroborate results obtained from a sequence of four observations at Eglin Air Force Base, Florida. In both series the motions suggest the strong influence of a semidiurnal wave. A listing is given for each wind observation by components fo 2-km height increments. Nine observations from Thumba, India, are included, which represent a set of low altitude data useful for comparison.
Author

N72-15579# Laboratoire Central de l'Armement, Arcueil (France).
EXPERIMENTS IN CORRELATING THE RADIOACTIVITY OF THE AIR AND PRECIPITATIONS AT GROUND LEVEL WITH VARIOUS METEOROLOGICAL PARAMETERS
J. M. Kientzel and P. Cambon Jan. 1971 67 p refs In FRENCH
(LCA/MS-RAE-3/641) Avail: AEC Depository Libraries

Radioactivity measurements taken over a three year period in the Paris area are considered. The experiments demonstrate the influence of certain factors, such as the origin of the air masses, the nature of the cloud layers, and the frequency of precipitation. No correlation between the results obtained and the height of the tropopause was found. Author (NSA)

N72-15580# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 89, NO. 3: TWO YEARS RECORDING OF THE STATIC POTENTIAL GRADIENT. FIRST RESULTS FROM REGULAR RECORDING OF THE STATIC POTENTIAL GRADIENT SINCE DECEMBER 1967 IN CONNECTION WITH THE PASSAGE OF RADAR ECHOES AND OTHER METEOROLOGICAL ELEMENTS
Hasso Vogt 1970 75 p refs In GERMAN; ENGLISH summary Sponsored in part by Deut. Forschungsgemeinschaft
Avail: NTIS

The near ground potential gradient of air was observed over a two year period. From these observations, an attempt was made to develop a simple climatological pattern of the potential gradient of the disturbed electric field. Particular emphasis was placed on the influence of local precipitation, especially the effect of showers and thunderstorms on the electric field of the near ground atmosphere. In order to demonstrate this influence, some examples of various forms of precipitation are shown. These examples, including snow, rain, showers, and thunderstorms, are described in the short-time variations of the potential gradient with the aid of weather-radar photos. The correlations of some meteorological elements with the potential gradient are discussed, along with the influence of precipitation on these correlations. The differences in the relations of the meteorological elements during the seasons of the year are also discussed.
Author (ESRO)

N72-15581# Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 119, NO. 4: WEATHER SATELLITE OBSERVATIONS AND THEIR EVALUATION. THE EUROPEAN CLIMATOLOGY 1970, PART 4 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 119, HEFT 4: WETTERSATELLITENBEOBACHTUNGEN UND IHRE AUSWERTUNG. DAS EUROPAEISCHE WETTERBILD 1970]
Matthias Eckardt, Ingrid Haupt, Ute Katergiannakis et al 1971 254 p refs In GERMAN; ENGLISH summary
(QR-4-Pt-4) Avail: NTIS

The daily European weather charts for the period October to December 1970 are given. The most significant orbital data from the ESSA A (APT pictures received by day) and Itos 1 C (IR pictures received by night) satellites are published. Some topical events in satellite meteorology, i.e. the American weather satellite NOAA1, launched on 11 December 1970, are mentioned. Finally, the snow and ice situation in Europe (excluding the Artic region) during the fourth quarter of 1970, and the French Peole satellite are discussed. ESRO

N72-15582# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, June 1971 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, JUIN 1971]
1971 15 p In DUTCH and FRENCH
Avail: NTIS

Meteorological parameters observed at different Belgian weather stations during June 1971 are given. ESRO

N72-15583# Army Foreign Science and Technology Center, Charlottesville, Va.
AUTOMATIC MULTIPOINT SYSTEM FOR MEASUREMENT OF MICROPHYSICAL CHARACTERISTICS OF FOG IN EXPERIMENTAL INSTALLATIONS
Yu. I. Moiseenko and G. I. Shchelchkov 28 Jul. 1971 18 p refs Transl. into ENGLISH from Tr. Inst. Eksp. Meteorol. (USSR),

no. 1, 1969 p 17-26
(AD-728738; FSTC-HT-23-996-71) Avail: NTIS CSCL 04/2

An automatic, 5-point system for measurement of the concentration and distribution spectrum of fog droplets has been developed and is in operation. Extended testing and comparison with other devices have demonstrated the reliability of the results produced using this system. Author (GRA)

N72-15584# Technology, Inc., Dayton, Ohio.
A SUMMARY OF ATMOSPHERIC TURBULENCE RECORDED BY NATO AIRCRAFT
Cyril G. Peckham London AGARD Sep. 1971 133 p refs Prepared for AGARD. Working Group on Environ. Statistical Data
(Contract AGARD-OTAN-SMP-67-68)
(AD-731152; AGARD-R-586-71; UDC-551.551.5) Avail: NTIS CSCL 04/2

The document describes 150,000 hours of turbulence data collected from seven participating NATO countries, the instruments used to measure the data, and the methods of processing the data and of separating the turbulence data from the maneuver data. In addition, it details the power spectral density methods used to derive gust velocities which are presented by altitude. Author (GRA)

N72-15585# Dayton Univ. Research Inst., Ohio.
STATISTICAL ANALYSIS OF LO-LOCAT TURBULENCE DATA FOR USE IN THE DEVELOPMENT OF REVISED GUST CRITERIA
John W. McCloskey, James K. Luers, John P. Ryan, and Nicholas A. Engler Wright-Patterson AFB, Ohio AFFDL Apr. 1971 142 p refs
(Contract F33615-69-C-1477)
(AD-731139; AFFDL-TR-71-29) Avail: NTIS CSCL 04/2

LO-LOCAT is an extensive low level turbulence program utilizing statistically representative samples of turbulence data obtained over a wide range of meteorological, topographical, seasonal, and time of day conditions. UDRI has attempted to identify which of the various meteorological and environmental conditions affect the turbulence as reflected through a number of turbulence parameters. The turbulence parameters considered were: sigma, the standard deviation of the gust velocity; b, the turbulence intensity; L, the scale of turbulence; and N(o), the characteristic frequency. The basic method of mathematical analysis was a stepwise regression scheme which related the environmental conditions to the various turbulence parameters based upon statistical priority. It is felt that the regression scheme provides a detailed outline of statistical relationships which can be used as a guide for further investigation. Author (GRA)

N72-15586# Environmental Technical Applications Center (Air Force), Washington, D.C.
A RESUME OF SHORT RANGE FORECASTING TECHNIQUES
Joe S. Restivo Sep. 1971 15 p refs
(AD-731162; USAFETAC-TN-71-10) Avail: NTIS CSCL 04/2

Certain techniques applicable to improve short-range forecasting are discussed briefly and references are furnished from which the reader can obtain detailed information on the various methods. Author (GRA)

N72-15587# Air Weather Service, Scott AFB, Ill.
ENVIRONMENTAL MEASURING EQUIPMENT USE BY AIR WEATHER SERVICE IN SUPPORT OF AIR FORCE AND ARMY OPERATIONS Air Weather Service Pamphlet
30 Jul. 1971 261 p refs Supersedes AD-822895
(AD-731165; AWS-PAM-105-3) Avail: NTIS CSCL 04/2

The report lists standardized environment-measuring equipment used by AWS activities (except communications equipment); for each item is given the official designation, a functional description, name of manufacturer, original unit cost, differences between models, accuracy, and miscellaneous remarks. A few non- or limited-standard items are included. Author (GRA)

N72-15588# Air Force Global Weather Central, Offutt AFB, Nebraska.
TURBULENCE FORECASTING PROCEDURES
Paul T. Burnett 15 Dec. 1970 87 p refs
(AD-731134; AFGWC-TM-70-7) Avail: NTIS CSCL 04/2

The Air Force Global Weather Central operational procedures are described for the forecasting of low-level mechanical, mountain wave associated, and clear air turbulence significant to aircraft. These procedures involve both manual and automated diagnostic techniques for analyzing individual rawinsonde soundings, data at constant pressure levels, and data from the AFGWC planetary boundary layer model. Brief outlines of computational procedures used in the computer diagnostic and prognostic programs are included. The basic forecast procedure is to associate reported turbulent and potentially turbulent areas with meteorological and orographic features, forecast the future positions of the meteorological features, and re-associate the turbulent areas. Forecasts of low-level mechanical turbulence rely to a considerable extent on prognoses of a numerical turbulence index. Index parameters are the gradient level wind, vertical motion, low-level atmospheric stability, 3-hourly sea-level pressure change, and terrain roughness. Formation of mountain waves is forecasted using an automated adaptation of the Harrison technique, and considers sea-level pressure gradients and wind data above the mountain range. Author (GRA)

N72-15589# Weather Squadron (24th), Moody AFB, Ga. Detachment 23.
TERMINAL FORECAST REFERENCE FILE, MOODY AFB, GEORGIA Final Report
17 Sep. 1971 106 p
(AD-730328) Avail: NTIS CSCL 04/2

This reference file discusses factors affecting the weather at Moody AFB, GA. Included are location and topography, weather controls, climatic aids, and forecasting guides. Author (GRA)

N72-15590# National Hurricane Research Lab., Miami, Fla.
PROJECT STORMFURY Annual Report, 1970
May 1971 176 p refs Sponsored in part by Navy
(Grant NSF G-17993; Proj. Stormfury)
(AD-730016; NOAA-71083002) Avail: NTIS CSCL 04/2

Project STORMFURY is a joint Department of Commerce (NOAA) - Department of Defense (Navy) program of scientific experiments designed to explore the structure and dynamics of tropical cyclones and their potential for modification. The Project which was formally established in 1962 has as its principal objective experimentation directed towards changing the hurricane's energy exchange by strategic seeding from aircraft with silver iodide crystals. The crystals are dispensed from pyrotechnic devices developed by the U. S. Navy. The hypothesis calls for a measurable decrease in the maximum wind velocities near the center of the storm. Navy and NOAA scientists and aircraft, supplemented by those of the U.S. Air Force, have cooperated in STORMFURY experimental operations since 1962 when the Project began. The 1970 hurricane season produced no tropical cyclones which were eligible for seeding experiments. In spite of this, or perhaps because of it, the 1970 season was undoubtedly the most productive research period for Project STORMFURY to date. Author (GRA)

N72-15591# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ICE FOG MODIFICATION BY USE OF HELICOPTERS
James R. Hicks and Motoi Kumai Sep. 1971 13 p refs
(DA Proj. 1T0-61102-B-52-A; DA Proj. 1T0-62111-A-126)
(AD-731215; CRREL-SR-162) Avail: NTIS CSCL 04/2

The objects of the report are to increase the knowledge of the physical and optical properties of ice fog and to develop

techniques for its dispersal. Two series of flight tests to determine the effects of CH-47 helicopter downwash on ice fog were conducted near Ft. Wainwright, Alaska, in January 1971. During the first series, clearings were produced which were large enough for helicopter operations. This series of tests was conducted when the ice fog was in a dissipating state. The second series of tests was conducted in a denser ice fog during its developing stage. The same flight procedures were used, but clearings were not produced. Author (GRA)

N72-15592# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
APPLICATION OF THE IDEAL CANOPY FLOW CONCEPT TO NATURAL AND ARTIFICIAL ROUGHNESS ELEMENTS
Ronald M. Cionco Apr. 1971 85 p refs
(Task-1T061102-B-53-A-17)
(AD-730638; ECOM-5372) Avail: NTIS CSCL 04/2

Effort has been expended in modeling air flow within and above simple roughness elements for neutral steady-state conditions. Application of the ideal canopy flow concept suggested by Cionco, Ohmstede and Appleby is now extended to various natural and artificial canopies of simple or complex structure. Properties and characteristics considered were: shape of the unit canopy wind profile, intensity of turbulence magnitudes, an index of canopy flow, and the effects of density and flexibility variations upon the flow. The profile shape is characteristic and best described by an exponential relationship within simple-structured elements. In complex structures, the profiles exhibited low-level maximums and no-gradient layers. Above the vegetation, the logarithmic wind relation was valid for each canopy type. Intensity of turbulence was relatively uniform with height for simple canopies and significantly non-uniform with height in complex structures, with large leaf area maximums and very low wind speeds. The ideal canopy flow concept can potentially serve many disciplines and efforts besides micrometeorology and diffusion research. If to serve no other purpose, it can be used to establish the initial formulation of a boundary condition or minor portion of a larger problem. The mathematical simplicity of the concept may be its most important quality when it is to be used as part of a larger system of equations. Author (GRA)

N72-15593# Air Force Global Weather Central, Offutt AFB, Nebraska.
AFGWC DIVERGENT MESO SCALE PREDICTION MODEL
James Kerlin 1 Jun. 1971 26 p refs
(AD-731196; AFGWC-TM-71-1) Avail: NTIS CSCL 04/2

A follow-on improved meso-scale weather prediction model is described. Using the previously developed AFGWC meso-scale prediction model as a test-bed, a refined model was developed. Data initialization procedures were modified to separate the stream function from the irrotational component of the wind, retaining the divergent portion of the wind field. The resulting field, used as input to the prediction model, more nearly reflects actual atmospheric conditions without introducing spurious noise detrimental to numerical forecasts. Author (GRA)

N72-15594# Air Force Global Weather Central, Offutt AFB, Nebraska.
VERIFICATION DATA: AFGWC-1000mb MACRO-SCALE PREDICTION MODEL
James Kerlin 1 Sep. 1971 16 p
(AD-730627; AFGWC-TN-71-5) Avail: NTIS CSCL 04/2

Forecasts produced by the 1000 mb macroscale prediction model are compared with observational data from rawinsonde sites. Monthly summaries are included for March, April, and May 1971. These summaries contain frequency distribution and error statistics for 12, 24, and 36 hour forecasts of temperature and D-value. Author (GRA)

N72-15595# Air Weather Service, Scott AFB, Ill.
INTRODUCTION TO LIGHTNING AND OTHER ELECTROSTATIC PHENOMENA
Nixon A. Adams Aug. 1971 56 p refs
(AD-730622; AWS-TR-224) Avail: NTIS CSCL 04/2

The technical report points out the importance of forecasters in the field understanding the basic physical principles of the lightning stroke, the lightning flash, and certain other electrostatic phenomena. Several varied theories on the creation of negative and positive charge centers in cumulo-nimbus clouds are presented by the author for the readers consideration. The integral parts of a single lightning flash are covered in detail and the author furnishes a better insight to the lightning phenomenon than normally held by the weather forecasters in the field. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N72-15596# Communications Research Centre, Ottawa (Ontario). Rept. of Communications.
STABILITY OF A DUAL SPIN SATELLITE WITH TWO DAMPERS IN CIRCULAR ORBIT
F. R. Vigneron Dec. 1970 26 p refs
(CRC-1212) Avail: NTIS

The motion of a dual spin satellite in circular orbit is studied to determine the effect of gravitational torques and damping when the spin vector is approximately normal to the orbit plane. Solutions are obtained analytically for high spin cases using the method of averaging to demonstrate the effect of gravitational torque and damping on both rotor and despun platform. For the high spin cases, stability criteria are identical with criteria previously derived for a freely spinning untorqued dual spin satellite. Author

N72-15597*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NUTATIONAL STABILITY OF A DUAL-SPIN SATELLITE UNDER THE INFLUENCE OF APPLIED REACTION TORQUES
Peter M. Bainum Sep. 1971 33 p refs Submitted for publication
(NASA-TM-X-65789; X-732-71-335) Avail: NTIS CSCL 22C

It is assumed that since the solar paddle attachments to the hub of the spacecraft are not rigidly locked, the effect of the solar panels can be replaced by a constant reaction torque acting on the hub of the spacecraft. This could result in the satellite having an equilibrium motion about an axis displaced from the nominal axis of symmetry. The variational equations of motion are developed about such an equilibrium position using the SAS-A spacecraft as a model. Energy dissipation on the rotor as well as the main body is included. This nonautonomous set of differential equations are linearized and transformed to an autonomous set using the Liapunov reducibility theorem. The stability of the kinematically similar system is examined numerically using representative SAS-A parameters for the case when either pair of solar panels is assumed to be loosely attached. Stability is verified for small system nutation angles (0.1 degree). Author

N72-15598# Institute for Telecommunication Sciences, Boulder, Colo.
INTERFERENCE PREDICTIONS FOR VHF/UHF AIR NAVIGATION AIDS (SUPPLEMENT TO IER 26-ITSA 26 AND ERL 138-ITS 95)
G. D. Gierhart and M. E. Johnson Jan. 1971 64 p refs
(Contract DOT-FA-68-WAI-145)
(AD-718465; OT/ITSTM-19) Avail: NTIS CSCL 17/7

A supplement is presented to information previously developed on interference predictions for VHF/UHF air navigation aids. Included are: (1) radiation patterns needed to adapt curves

previously developed for the instrument landing system (ILS) localizer and tactical air navigation (TACAN) to new equipment types, (2) comparisons of the propagation models used for predictions made from 1962 to the present, (3) propagation information in a different form, i.e. attenuation greater than free space for distance measuring equipment (DME), TACAN and VHF omnirange (VOR), (4) DME, TACAN and VOR service volume without interference curves for equipment configurations not previously considered, and (5) an errata list for earlier ESSA technical reports. Author

N72-15599# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
PROPORTIONAL NAVIGATION: A SINGULAR PROBLEM IN OPTIMAL CONTROL
J. K. Hammond Sep. 1971 9 p refs
(AASU-309) Avail: NTIS

It is shown that classical proportional navigation in a much simplified missile homing situation is a non-unique solution to a singular problem which results from the application of optimal control theory to homing. Based on a typical homing geometry the original line of sight was taken as a datum and perturbations from this were considered. An optimal control formulation of the problem is given, and minimum principle is used to determine control action. It is found that there is an infinite number of controllers to provide a solution to the singular problem in optimal control formulation, and that there is no unique singular solution. Conclusively, the problem was inadequately formulated for the application of optimal control theory. ESRO

N72-15600# Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.
CORRECTIONS FOR TROPOSHERIC RANGE ERROR
Edward E. Altshuler 27 Jul. 1971 46 p refs
(AF Proj. 8682-03-01)
(AD-731170; AFCRL-71-0419; AFCRL-ERP-369) Avail: NTIS CSCL 17/7

Satellite systems like the 621B have been proposed for air traffic control and navigation. Such systems are designed to provide aircraft position and velocity data based on time delay measurements of propagation between the aircraft and a network of satellites. Since the index of refraction of the troposphere is greater than unity, radiowaves propagate through the troposphere slower than through freespace and the time delay is therefore longer. Range error corrections calculated from various models of index of refraction generally require the use of numerical methods and a large capacity high speed computer, particularly for low elevation angles. This paper presents a simple emprical expression for range error for elevation angles above 5 degrees. The CRPL Reference Atmosphere 1958 was the model used. A simple regression line that yields range error corrections within 1 percent of the values obtained by means of more sophisticated techniques was derived. GRA

N72-15601# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AIR TRAFFIC CONTROL Quarterly Technical Summary Report, 1 May - 31 Jul. 1971
Herbert G. Weiss 15 Aug. 1971 15 p refs
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-730601; ESD-TR-71-248) Avail: NTIS CSCL 17/7

The report describes the activities in air traffic control which are funded by the Air Force. Where these activities have led to projects supported by other agencies or are intimately related to such work, this interrelationship has been noted. Progress on other ATC tasks during this quarter included the completion of a Technical Development Plan for a Discrete Address Beacon System for the FAA, two studies relating to Fourth Generation ATC System Concepts for the Transportation Systems Center of DOT, and the Evaluation of a Laser Beam Alerting System for Logan Airport sponsored by the Massachusetts Port Authority. Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N72-15602 National Lending Library for Science and Technology, Boston Spa (England).
INFLUENCE OF DELAYED NEUTRONS ON THE DYNAMIC REACTIVITY OF A REACTOR DURING FUEL DENSITY OSCILLATIONS
V. L. Blinken and V. M. Novikov 28 Jul. 1971 15 p refs
(NLL-Risley-Tr-2099-(9091.9F)) Avail: Natl. Lending Library, Boston Spa. Engl: 2 photocopy coupons

A mathematical model is developed for the dynamic reactivity including the effects of delayed neutrons for an infinite reactor and for a finite reactor. The analysis shows that the presence of delayed neutrons does not change the sign of reactivity during fuel density oscillations, but the law of variation in reactivity is essentially different from that of static variation. N.E.N.

N72-15603 National Lending Library for Science and Technology, Boston Spa (England).
SYSTEMATIC EXPERIMENTAL STUDY OF THE DEPENDENCE OF THE PRESSURE LOSS ON THE GEOMETRICAL ARRANGEMENT FOR ROD BUNDLES WITH SPIRAL WIRE SPACERS IN A LONGITUDINAL FLOW M.S. Thesis - Karlsruhe Univ.
Klaus Rehme 10 Nov. 1971 31 p Transl. into ENGLISH of German thesis
(NLL-Risley-Tr-2256-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

Geometrical parameters of the rod bundles were systematically varied and the pressure losses were measured over a Reynolds number range from 2000 to 200,000. The parameters varied were spiral pitch, rod spacing ratio, and the number of rods in the bundle. The rods had spirals of the same hand and were arranged in a hexagonal assembly. The results were found to agree with published measured values. N.E.N.

N72-15604*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EMERGENCY COOLING ANALYSIS FOR THE LOSS OF COOLANT MALFUNCTION
John A. Peoples Washington Jan. 1972 33 p refs
(NASA-TM-X-2464; E-6520) Avail: NTIS CSCL 18I

This report examines the dynamic response of a conceptual space power fast-spectrum lithium cooled reactor to the loss of coolant malfunction and several emergency cooling concepts. The results show that, following the loss of primary coolant, the peak temperatures of the center most 73 fuel elements can range from 2556 K to the region of the fuel melting point of 3122 K within 3600 seconds after the start of the accident. Two types of emergency aftercooling concepts were examined: (1) full core open loop cooling and (2) partial core closed loop cooling. The full core open loop concept is a one pass method of supplying lithium to the 247 fuel pins. This method can maintain fuel temperature below the 1611 K transient damage limit but requires a sizable 22,680-kilogram auxiliary lithium supply. The second concept utilizes a redundant internal closed loop to supply lithium to only the central area of each hexagonal fuel array. By using this method and supplying lithium to only the triflute region, fuel temperatures can be held well below the transient damage limit. Author

N72-15605*# Aerojet-General Corp., Azusa, Calif.
SNAP-8 ELECTRICAL GENERATING SYSTEM DEVELOPMENT PROGRAM Final Report

15 Jul. 1971 465 p
(Contracts NAS3-13458; NAS5-417)
(NASA-CR-72860) Avail: NTIS HC $6.00/MF $0.95 CSCL 18N

The SNAP-8 program has developed the technology base for one class of multikilowatt dynamic space power systems. Electrical power is generated by a turbine-alternator in a mercury Rankine-cycle loop to which heat is transferred and removed by means of sodium-potassium eutectic alloy subsystems. Final system overall criteria include a five-year operating life, restartability, man rating, and deliverable power in the 90 kWe range. The basic technology was demonstrated by more than 400,000 hours of major component endurance testing and numerous startup and shutdown cycles. A test system, comprised of developed components, delivered up to 35 kWe for a period exceeding 12,000 hours. The SNAP-8 system baseline is considered to have achieved a level of technology suitable for final application development for long-term multikilowatt space missions. Author

N72-15606*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF LOSS-OF-COOLANT ACCIDENT FOR A FAST-SPECTRUM LITHIUM-COOLED NUCLEAR REACTOR FOR SPACE-POWER APPLICATIONS
George E. Turney, Edward J. Petrik, and Arthur W. Kieffer Washington Jan. 1972 35 p refs
(NASA-TM-X-2483; E-6571) Avail: NTIS CSCL 18I

A two-dimensional, transient, heat-transfer analysis was made to determine the temperature response in the core of a conceptual space-power nuclear reactor following a total loss of reactor coolant. With loss of coolant from the reactor, the controlling mode of heat transfer is thermal radiation. In one of the schemes considered for removing decay heat from the core, it was assumed that the 4 pi shield which surrounds the core acts as a constant-temperature sink (temperature, 700 K) for absorption of thermal radiation from the core. Results based on this scheme of heat removal show that melting of fuel in the core is possible only when the emissivity of the heat-radiating surfaces in the core is less than about 0.40. In another scheme for removing the afterheat, the core centerline fuel pin was replaced by a redundant, constant temperature, coolant channel. Based on an emissivity of 0.20 for all material surfaces in the core, the calculated maximum fuel temperature for this scheme of heat removal was 2840 K, or about 90 K less than the melting temperature of the UN fuel. Author

N72-15607*# General Electric Co., Cincinnati, Ohio.
CONCEPTUAL DESIGN STUDY OF A NUCLEAR BRAYTON TURBOALTERNATOR-COMPRESSOR
Washington NASA Nov. 1971 526 p refs
(Contract NAS3-13449)
(NASA-CR-113925; GESP-493) Avail: NTIS HC $6.00/MF $0.95 CSCL 18I

A comprehensive analysis and conceptual design study of the turboalternator-compressor components using HeXe as the working fluid was performed. The study was conducted in three phases: general configuration analysis (Phase 1), design variations (Phase 2), and conceptual design study (Phase 3). During the Phase 1 analysis, individual turbine, alternator, compressor, and bearing and seal designs were evaluated. Six turboalternator-compressor (TAC) configurations were completed. Phase 2 consisted of evaluating one selected Phase 1 TAC configuration to calculate its performance when operating under new cycle conditions, namely, one higher and one lower turbine inlet temperature and one case with krypton as the working fluid. Based on the Phase 1 and 2 results, a TAC configuration that incorporated a radial compressor, a radial turbine, a Lundell alternator, and gas bearings was selected. During Phase 3 a new layout of the TAC was prepared that reflects the cycle state points necessary to accommodate a zirconium hydride moderated reactor and a 400 Hz alternator. The final TAC design rotates at 24,000 rpm and produces 160 kWe, 480 V, 3-phase, 400 hertz power. Author

N72-15608*# Aerojet-General Corp., Azusa, Calif.
SNAP-8 ELECTRICAL GENERATING SYSTEM DEVELOPMENT PROGRAM
Washington NASA Nov. 1971 466 p refs
(Contracts NAS3-13458; NAS5-417)
(NASA-CR-1907; Rept-1960-71) Avail: NTIS HC $6.00/MF $0.95 CSCL 18N

The SNAP-8 program has developed the technology base for one class of multikilowatt dynamic space power systems. Electrical power is generated by a turbine-alternator in a mercury Rankine-cycle loop to which heat is transferred and removed by means of sodium-potassium eutectic alloy subsystems. Final system overall criteria include a five-year operating life, restartability, man rating, and deliverable power in the 90 kWe range. The basic technology has been demonstrated by more than 400,000 hours of major component endurance testing and numerous startup and shutdown cycles. A test system, comprised of developed components, delivered up to 35 kWe for a period exceeding 12,000 hours. The SNAP-8 system baseline is considered to have achieved a level of technology suitable for final application development for long-term multikilowatt space missions. Author

N72-15609*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SHOCK AND VIBRATION TESTS OF URANIUM MONONITRIDE FUEL PELLETS FOR A SPACE POWER NUCLEAR REACTOR
Donald W. Adams Washington Feb. 1972 31 p refs
(NASA-TM-X-2493; E-6584) Avail: NTIS CSCL 18J

Shock and vibration tests were conducted on cylindrically shaped, depleted, uranium mononitride (UN) fuel pellets. The structural capabilities of the pellets were determined under exposure to shock and vibration loading which a nuclear reactor may encounter during launching into space. Various combinations of diametral and axial clearances between the pellets and their enclosing structures were tested. The results of these tests indicate that for present fabrication of UN pellets, a diametral clearance of 0.254 millimeter and an axial clearance of 0.025 millimeter are tolerable when subjected to launch-induced loads. Author

N72-15610# California Univ., Livermore. Lawrence Radiation Lab.
FUSION POWER
R. F. Post 26 Apr. 1971 25 p refs Presented at Symp. on Energy for the Future, Washington, D. C., 26 Apr. 1971 Sponsored by AEC
(UCRL-73158; Conf-710436-1) Avail: NTIS

A review of controlled thermonuclear research to date is given. The prospects of open and closed systems and direct energy conversion are discussed in general terms. NSA

N72-15611# Argonne National Lab., Ill. Center for Educational Affairs.
ARGONNE SAFEGUARDS TRAINING PROGRAM: A THREE YEAR HISTORY
Manuel A. Kanter 1971 8 p Presented at the 12th Ann. Meeting of the Nucl. Mat. Management, West Palm Beach, Fla., 29 Jun. 1971 Sponsored by AEC
(Conf-710617-11) Avail: NTIS

During its first three years of operation, the Argonne Safeguards Training Program has offered training in nuclear materials safeguards to over 200 participants from government and industry both foreign and domestic. Its offerings have ranged from a basic course intended for those who are new to the field to specialized workshops for the experienced practitioners. In addition a beginning was made in the teaching of safeguards and nuclear materials control in existing institutions of higher learning. Developing trends will be assessed as to their effect on future training programs. Author (NSA)

N72-15612# General Electric Co., Pleasanton, Calif.
CALCULATED INVENTORY DIFFERENCES: A POTENTIAL SAFEGUARDS AND MATERIAL CONTROL TECHNIQUE
L. T. Hagie, D. C. Wadekamper, and W. Marcuse 1971 26 p refs Presented at the 12th Ann. Meeting of the Nucl. Mater. Management, West Palm Beach, Fla., 29 Jun. - 1 Jul. 1971
(Contract AT(30-1)-68)
(Conf-710617-9) Avail: NTIS

The use of calculated inventory differences as a potential material control measure has been tested as part of the Integrated Safeguards Experiment. During the fabrication of 48 mixed oxide (urania and plutonia) fuel rods material balances around individual process stations were calculated based on weights of materials transferred in and out of the system. Since the fabrication program was conducted in a series of process campaigns for individual fuel enrichments, it was possible to clean all processing equipment between enrichment levels and calculate material balances for each process station. The amount of material calculated to be remaining in the individual process stations after the between-enrichment clean-outs is termed the calculated inventory difference. Author (NSA)

N72-15613# Oak Ridge National Lab., Tenn.
STUDIES IN APPLIED SOLID MECHANICS (NUCLEAR SAFETY) Annual Progress Report
W. L. Greenstreet, S. E. Moore, and J. P. Callahn Jul. 1971 73 p refs
(Contract W-7405-eng-26)
(ORNL-4693; APR-2; UC-80) Avail: NTIS

Activities during calendar year 1970 in programs for developing structural design technology for piping components and for attachments of nozzles to pressure vessels are summarized. Both theoretical and experimental efforts are under way to develop improved design methods for assuring, on a practical level, the structural integrity of pressure vessels and primary coolant systems of nuclear power plants. Applications of the technology developed are not limited, however, to nuclear reactor systems. Through these programs, experimental data on structural behavior are being obtained and experimentally proven methods of design analysis established. Design rules and analytical procedures for incorporation into current industry-developed standards and USAEC Division of Reactor Development and Technology (RDT) supplemental standards are also derived. Discussions of piping and nozzle developments are included.
Author (NSA)

N72-15614# Oak Ridge National Lab., Tenn. Neutron Physics Div.
FAST REACTOR SHIELDING ACTIVITY NO. 40 01 61, 189A NO. 10028 Monthly Progress Report, Jul. 1971
F. R. Mynatt, C. E. Clifford, M. L. Gritzner, and R. E. Maerker 25 Aug. 1971 28 p
(ORNL-TM-3538) Avail: NTIS

Schedules for the experimental and analytical programs during fiscal 1972 are presented. Activities during July 1971 included: (1) transport method development for metal shields; (2) Fast Flux Test Facility design calculations; (3) Monte Carlo transport through iron; and (4) Tower Shielding Facility experiments. NSA

N72-15615# IIT Research Inst., Chicago, Ill.
NUCLEAR WEAPONS EFFECTS: DUST AND AIR TEMPERATURE ENVIRONMENT Final Technical Report, May 1966 - Sep. 1969
James J. Swatosh, Jr. and Arne H. Wiedermann Feb. 1971 284 p refs
(Contract DACA73-67-C-0018)
(AD-729426; CERL-TM-S-2-Rev) Avail: NTIS CSCL 09/2

The report presents a computer program for calculating the dust and air temperature environment resulting from nuclear weapons detonations. The program can accommodate a wide variety of weapons detonations and ground surfaces. A weapons effects subroutine limits battle environment input data to the bare minimum. Dust concentrations can be calculated at any significant range from ground zero and at any height to which dust is raised by blast wind erosion of soil and subsequent air transport. The soil may be considered either uniform or variable in the path of the blast wave. Soils are specified by particle size and terminal velocity, size distribution, and erodable depth. Land use is accounted for. The topography is assumed to be flat or gently rolling. Multiple burst dust concentrations can be computed for variously timed detonations. The effect of prevailing winds is introduced after cessation of blast winds. Air temperature is treated as a dust-related phenomenon. The ground, heated by thermal radiation prior to arrival of the air blast, is eroded and transported by the blast wind. Its heat is transferred to air, primarily by convection, until thermal equilibrium is attained. The dust present from preceding bursts acts as a heat shield, transmitting only a portion of thermal radiation from succeeding bursts. Author (GRA)

N72-15616# Armed Forces Radiobiology Research Inst., Bethesda, Md.
A PULSE REACTOR RADIATION DETECTION SYSTEM USING AN ON-LINE COMPUTER
B. E. Leonard, W. F. Pfeiffer, and D. A. Hughes Jul. 1971 31 p refs
(DNA Proj. NWER-XAXM; Task-D908)
(AD-731350; AFRRI-TN71-3) Avail: NTIS CSCL 18/4

A pulse reactor radiation detection system is described. The system uses an on-line Scientific Data Systems (SDS) 920 computer, coupled through an analog to digital converting interface, to record and retain the response data for various radiation detectors. Results of typical measurements are presented. An overall range of sensitivity of one million is possible with a precision to within about 5 percent (exclusive of the detectors) for determining relative reactor power, neutron and gamma ray flux densities (if the spectra remain constant), and neutron and gamma ray tissue kerma rates or the time integral of these quantities. This range is achieved using combinations of radiation sensors. Author (GRA)

N72-15828 Sandia Labs., Albuquerque, N.Mex.
IMPACT TESTS OF NUCLEAR FUEL MATRICES USING A VACUUM TUBE LAUNCHER
H. W. Nunez *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 193-204 (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N72-15617 Polytechnic Inst. of Brooklyn, N.Y.
MAGNETIC HOLOGRAPHY Ph.D. Thesis
Reuben Saul Mezrich 1970 151 p
Avail: Univ. Microfilms Order No. 70-26085

Magnetic holography is an optical recording and reconstruction technique which combines the best features of magnetic and holographic storage. In contrast to the situation in magneto-optics, reconstruction may be obtained with either polarized or unpolarized light using either the Faraday or polar Kerr magneto-optic effects. Furthermore, if linearly polarized light is used for reconstruction the output will be linearly, not elliptically, polarized. In contrast to the usual case in holography, the first order diffracted wave is polarized at 90 deg to both the

incident and zero'th order waves, which allows a considerable increase in the detected signal to noise. Magnetic holograms are formed by Curie point writing. A magnetization pattern, a thin ferromagnetic film, is formed in proportion to thermal variations caused by absorption of an incident optical interference pattern. The holograms are erased by applying a magnetic field which saturates the film, removing the holographic magnetization pattern. Dissert. Abstr.

N72-15618 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
ANALYSIS OF UNITS IN ELECTROMAGNETISM Publications of the Earth Physics branch, volume 42, no. 1
F. Primdahl 1971 27 p refs
(M70-42/1) Copyright. Avail: Issuing Activity

An analysis of the units of measurement used in electromagnetism calculations is presented. A common denominator in the form of a set of electromagnetic equations written independently of any unit system is provided. The characteristic features of some of the existing systems are described. The equations are derived as far as necessary to evaluate their general form and mathematical models are included. Author

N72-15619*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GYROSCOPE RELATIVITY EXPERIMENT
Rudolf Decher 18 Oct. 1971 40 p refs
(NASA-TM-X-64630) Avail: NTIS CSCL 12B

A gyroscope test of general relativity theory is proposed. The basic ideas and hardware concepts conceived by the investigators to implement the experiment are discussed. The goal is to measure the extremely small relativistic precession of gyroscopes in an earth-orbiting satellite. The experiment hardware (cryogenic gyroscopes, a telescope and superconducting circuits) is enclosed in a liquid helium dewar. The experiment will operate in orbit for about one year. Author

N72-15620*# Scientific Translation Service, Santa Barbara, Calif.
NEW METHOD FOR INFORMATION PICK UP FROM SPARK CHAMBERS
Yu. A. Karzhavin, A. T. Matyushin, V. T. Matyushin, and M. N. Khachaturyan Washington NASA Jan. 1971 10 p refs Transl. into ENGLISH of "Novy Sposob S'yema Inform. s Iskrovykh Kamer" Joint Inst. for Nucl. Res. Report P13-5016, Dubna, 1970 12 p
(Contract NASw-2035)
(NASA-TT-F-13839; P13-5016) Avail: NTIS CSCL 20C

A method is described for the passive location of an ultrasonic signal generated by a spark in the chamber electrode. The materials employed and the circuit diagrams are presented. Author

N72-15621# Saarland Univ., Saarbrucken (West Germany).
THE EQUIVALENCE WIDTH OF MULTIPLETS WITH HYPERFINE STRUCTURES IN THE HOMOGENOUS MAGNETIC FIELD Ph.D. Thesis [DIE AEQUIVALENTBREITE VON MULTIPLETTS MIT HYPERFEINSTRUKTUR IM HOMOGENEN MAGNETFELD]
Walter Stopp 1971 107 p refs In GERMAN
Avail: NTIS

Quantum mechanical perturbation equations are formulated and used to determine the effects of a homogeneous magnetic field on the multiple structures of hyperfine and fine Na-D1-and Na-D2-lines. Results show that equivalent widths diminish because of the dependence of the interatomic spin-coupling impulse on the magnetic field. Transl. by G.G.

N72-15622*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVICE AND METHOD FOR DETERMINING X-RAY REFLECTION EFFICIENCY OF OPTICAL SURFACES Patent Application
Stanley A. Fields and John M. Reynolds, inventors (to NASA) Filed 31 Jul. 1970 10 p
(NASA-Case-MFS-20243; US-Patent-Appl-SN-59894) Avail: NTIS CSCL 20F

A device and method for testing the X-ray reflection efficiency and scattering properties of various optical surfaces are given. The system comprises a crystal monochromator mounted to receive and diffract X-rays generated by an X-ray source. The X-rays are diffracted from the crystal so as to impinge on the optical surface being tested. The X-rays reflected by the optical surface are directed toward a detector capable of indicating the intensity of the X-rays reflected by the optical surface. Intensity readings are initially made of X-rays diffracted directly from the crystal to a detector and subsequently are made of the identical X-rays diffracted from the crystal to the optical surface and reflected to a detector. The crystal, optical surface test specimen and detectors are mounted for rotation to desired angle positions and the entire apparatus is enclosed in a vacuum chamber. NASA

N72-15623*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF SURFACE CONTAMINATION ON THE INFRARED EMISSIVITY AND VISIBLE-LIGHT SCATTERING OF HIGHLY REFLECTIVE SURFACES AT CRYOGENIC TEMPERATURES
Walter Viehmann and Alfred G. Eubanks Washington Feb. 1972 14 p refs
(NASA-TN-D-6585; G-1045) Avail: NTIS CSCL 20F

A technique is described for the simultaneous in situ measurement of film thickness, refractive index, total normal emissivity, visible-light scattering, and reflectance of contaminant films on a highly reflective liquid-nitrogen cooled, stainless steel substrate. Emissivities and scattering data are obtained for films of water, carbon dioxide, silicone oil, and a number of aromatic and aliphatic hydrocarbons as a function of film thickness between zero and 20 microns. Of the contaminants investigated, water has by far the greatest effect on emissivity, followed by silicone oil, aliphatic hydrocarbons, aromatic hydrocarbons, and carbon dioxide. The emissivity increases more rapidly with film thickness between zero and 2.5 microns than at thicknesses greater than 2.5 microns. Scattering of visible light changes very little below 2 microns thickness but increases rapidly with thickness beyond 2 to 3 micorns. The effect of contaminant films on passive radiation coolers is discussed. Author

N72-15624*# Denver Research Inst., Colo. Industrial Economics Div.
APPLICATIONS OF AEROSPACE TECHNOLOGY IN INDUSTRY. A TECHNOLOGY TRANSFER PROFILE: CRYOGENICS
Dec. 1971 146 p refs
(Contract NSR-06-004-063)
(NASA-CR-125426) Avail: NTIS CSCL 20L

Cryogenics is especially interesting when viewed from the perspective of technology transfer. Its recent rapid growth has been due to demands of both industry and aerospace. This environment provides an unusual opportunity to identify some of the forces active during a period of broad technological change and at the same time further the understanding of the technology transfer process. That process is specifically defined here as the ways in which technology, generated in NASA programs, contributes to technological change. In addition to presenting a brief overview of the cryogenics field and describing certain representative examples of the transfer of NASA-generated technology to the private sector, this presentation explores a singular relationship between NASA and another federal agency, the National Bureau of Standards. The relationship has operated both to generate and disseminate information fundamental to the broad growth of the cryogenics field. Author

N72-15625*# Stanford Research Inst., Menlo Park, Calif.
THE STRUCTURE OF JET TURBULENCE PRODUCING JET NOISE Annual Report
C. E. Wooldridge, D. C. Wooten, and A. J. Amaro Jun. 1971 72 p refs
(Contract NASw-1938; SRI Proj. SCU-8139)
(NASA-CR-126483) Avail: NTIS CSCL 20A

The structure of the turbulence in the mixing region for the first few diameters downstream from the outlet of a circular subsonic jet is characterized at three Mach numbers, 0.3, 0.5, and 0.7, with most of the measurements taken at M = 0.3. Profiles of turbulence intensity showed that downstream of the lip intensity is independent of axial distance, while in the core intensity varies by a factor of eight between the jet outlet and the end of the core. A digital data reduction program was used to calculate the auto- and cross-correlations of axial velocity fluctuations and the power spectral densities. Convection velocities were measured using broadband, hot wire signals and signals that were digitally filtered for band-passes about center frequencies of 0.8, 1.3, 1.6, and 3.2 kHz. The center frequency of 1.3 kHz corresponded to the peak energy in the core spectrum. The results support the hypothesis that the coherent pressure field is driven by the intermittent fluctuations at the core boundary, which in turn are related to the large (low frequency) eddies.
Author

N72-15626# Technische Hogeschool, Delft (Netherlands).
RIGOROUS DIFFRACTION THEORY OF OPTICAL REFLECTION AND TRANSMISSION GRATINGS Ph.D. Thesis
Petrus Maria VanDenBerg 1971 171 p refs
Avail: NTIS

A diffraction theory of optical reflection and transmission gratings is developed. All configurations under consideration are cylindrical in one direction and consist of a perfectly reflecting periodic boundary and/or a dielectric medium of which one boundary is periodic. When an electromagnetic wave is incident on a periodic structure of this kind the diffracted field consists of a discrete set of waves (the so-called spectral orders) propagating only in certain directions. The angles of diffraction of these spectral orders follow from the Rayleigh grating formula (to be modified in case different media are present) and are determined by the angle of incidence, the wavelength of the diffracted waves in the relevant medium and the spatial period of the boundary. The amplitudes and phases of the diffracted waves depend on the particular shape and the period of the boundary, the boundary conditions to be imposed at the surface of the grating, as well as by the angle of incidence and the wavelength of the incident wave and the properties of the dielectric media if present.
Author

N72-15627# Royal Inst. of Tech., Stockholm (Sweden).
EXPERIMENTAL STUDIES OF SUPERCONDUCTING WEAK LINKS AND FLUX-LINE DYNAMICS IN TYPE-2 SUPERCONDUCTORS Ph.D. Thesis
Bruno Slettenmark 1971 173 p refs
Avail: NTIS

Research on semiconducting quantum devices and on the properties of superconducting niobium is reported. Different kinds of superconducting weak links and their applications are reviewed. Stable C-shaped and symmetric dc and RF voltage-biased semiconducting quantum interference devices (SQIDs) were designed and tested, and an easily constructed SQID with adjustable critical current of the point-contact is described. A model for the operation of a partly resistive superconducting point-contact quantum device is presented in which a general response function is calculated and approximate expressions for the frequency dependence and noise properties at high and low frequencies are given. Dip effects in the flux flow resistance in the mixed state of single crystallites of high purity niobium are investigated. Helicon resonances observed in the mixed state of high purity niobium are described, and the ac Hall angle is calculated from the Q-values of the resonance curves and is compared with dc Hall angles.
N.E.N.

N72-15628# SACLANT ASW Research Center, la Spezia (Italy).
COHERENT REFLECTION BY THE ROUGH SEA SURFACE OF THE ACOUSTIC FIELD FROM A SOURCE OF ARBITRARY DIRECTIVITY
Richard H. Clarke 15 Apr. 1970 28 p refs
(AD-870497; SACLANTCEN-TM-152) Avail: NTIS CSCL 17/1

The angular plane-wave spectrum representation of the acoustic field due to a source of arbitrary directivity is used to formulate the problem of scattering by a rough sea surface. An approximate solution is obtained by applying a Kirchhoff-type boundary condition at the surface. The solution suggests a straightforward modification of current ray-tracing techniques in order to estimate the coherent part of the reflected field.
Author

N72-15629# Scientific Translation Service, Ann Arbor, Mich.
DEVELOPMENT OF UNSTABLE CYCLOTRON OSCILLATIONS IN AN INHOMOGENEOUS MAGNETIC FIELD
A. V. Timofeev [1971] 29 p refs Transl. into ENGLISH of Russian report IAE-2089 Prepared for ORNL
(ORNL-TR-2495; IAE-2089) Avail: NTIS

The evolution of short-wave quasi-classical oscillations in inhomogeneous media is considered, using the Laplace transform method. The perturbations, arbitrarily depending on the coordinates, take the form of a superposition of elementary perturbations, which initially had the form of a delta function. An equation is derived establishing the frequency of the elementary perturbation as a function of the coordinates and of time. It is demonstrated that the concept of a wave packet in inhomogeneous media is of limited validity, since with a sufficiently sharp change in the oscillation increment in space, the interference of elementary perturbations forming the packet may lead to mutual cancellation. This is discussed with the example of unstable cyclotron oscillations in an inhomogeneous magnetic field. In a monotonically increasing field the perturbations increase for a finite time, after which their amplitude no longer varies. The magnification factor does not depend on the form of the perturbation.
Author (NSA)

N72-15630# Oak Ridge National Lab., Tenn. Office of Language Services.
PROPERTIES OF SPHERICALLY CORRECTED ACHROMATIC ELECTRON LENSES
H. Rose Aug. 1971 24 p refs Transl. into ENGLISH from Optik (Stuttgart), v. 33, no. 1, 1971 p 1-24
(ORNL-tr-2510) Avail: NTIS

An out-of-round corrective lens can compensate the third-order spherical aberration and the first-order chromatic aberration of a round lens. The fifth-order aperature aberration, the coma and the triple astigmatism of the corrected electron lens are calculated to get information on the resolution limit and on the number of image points which are resolved on a diameter of the image. The influence of focusing on axial astigmatism and the influence of field variations on phase contrast are investigated. A special corrected lens is given which has a solution limit of 0.5 A and which can resolve approximately 100 image points for 60 kV electrons.
Author (NSA)

N72-15631# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
THE CALCULATION OF ACHROMATIC PRISMS IN CHERENKOV COUNTERS
V. P. Zrelov, G. Sulekova, and P. Sulek Jun. 1971 16 p refs In RUSSIAN
(JINR-P13-5868) Avail: AEC Depository Libraries

The methods of calculating achromatic prisms used to compensate radiation dispersion in Cherenkov devices are considered. Such prisms give an opportunity to guide Vavilov-Cherenkov radiation of two different wave lengths in the same direction. The prism is considered which has both refraction faces in a general position relative to the direction of the particle motion. Also, the calculation of an achromatic prism, the input refractive face of which is perpendicular to the particle motion direction is considered. The ALGOL-60 algorithms are listed.
NSA

N72-15632# Brookhaven National Lab., Upton, N.Y. Accelerator Dept.
HIGH-FIELD BENDING MAGNETS
G. Parzen and K. Jellett 30 Jul. 1971 6 p refs
(BNL-16043; AADD-180; CRISP-71-20) Avail: NTIS

A small-aperture, high-field bending magnet having an aperture of 1.5 x 1.5 in. and a maximum field of 40 kg is considered. The magnet is an H-magnet and the field is corrected by means of two separately excited correction coils.
Author (NSA)

N72-15633# Brookhaven National Lab., Upton, N.Y. Accelerator Dept.
SMALL APERTURE HIGH-FIELD BENDING MAGNET
G. Parzen and K. Jellett 1 Jul. 1971 8 p refs
(BNL-16006; AADD-178; CRISP-71-12) Avail: NTIS

A small aperture high field bending magnet is proposed and studied for possible use in a high energy superconducting accelerator. The aperture is 1.5 x 1.5 in. and the maximum field is 40 kg. The magnet resembles an H-magnet, and retains some of the advantages of the simplicity of a window frame magnet, while possessing an exceptionally flat field, especially at the low and high field ends.
Author (NSA)

N72-15634# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
SOME SIMPLIFICATIONS CONCERNING CALCULATIONS IN AEROACOUSTICS [UEBER EINIGE VEREINFACHUNGEN BEI STROEMUNGSAKUSTISCHEN BERECHNUNGEN]
Dietrich Bechert 1971 32 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-25) Avail: NTIS; DFVLR, Porz: 10,70 DM

Some simplifications concerning mathematical calculations of problems of aeroacoustics are investigated. The equations of an inviscid nonstationary compressible flow are considered. The investigations are limited to small Mach numbers and to small magnitudes of the nonstationary perturbations. The equations are written for low and high Strouhal numbers. For low Strouhal numbers, it is shown that the equations of a stationary flow can be used. For high Strouhal numbers, sound field and flow become independent. Also, often the case of mean Strouhal number does occur. If the characteristic length of the problem is small compared to the length of the sound waves, the equations of a nonstationary incompressible flow can be used.
Author (ESRO)

N72-15635# Hardesty (George K. C.), Annapolis, Md.
CHROMATICITY COMPUTATIONAL FORMS FOR SOURCES FROM 1600 K TO 3200 K INCLUDING 2854 K (SOURCE A), AND SOURCES B, C, AND D6500 (16, 20, AND 40 ORDINATES)
George K. C. Hardesty Jul. 1971 79 p refs
(Contract N00161-70-C-0739; SF Proj. 35-423-001)
(AD-726199; NSRDL/A-6-88/70) Avail: NTIS CSCL 20/6

Three sets of computational forms are presented to facilitate the computation of Commission Internationale de L'Eclarige chromaticity coordinates of signal devices and luminous transmittance (or reflectance) values of colored materials. In each set of 16, 20, or 40 spectral ordinate forms, there is a form specific to a particular color temperature as applied to a tungsten lamp. The usual assumption is made that the spectral distribution of energy of a real (tungsten) source is proportional to that of a full radiator (blackbody) of the same color temperature. In addition, there are forms for the standardized non-Planckian sources B, C, and D6500 as well as for a theoretical equal energy source. The 40 ordinate (10 nanometer) forms cover the spectral range 380 to 770 nanometer while the 16 and 20 ordinate (20-nanometer interval) forms cover the span 400 to 700 and 380 to 670 nanometer, respectively. These forms are intended to correspond with the wave length sampling intervals of a number of contemporary spectral analyzing equipments or to practical limitations on data taken from continuous graphic spectral recordings. The use of these forms with transmittance and reflectance types of spectrophotometric data, and also spectroradiometric data is exemplified.
Author (GRA)

N72-15636# Cambridge Acoustical Associates, Inc., Mass.
REFRACTION AND FOCUSING OF UNDERWATER SHOCK WAVES: BIBLIOGRAPHY OF TECHNICAL REPORTS, MEMORANDA AND PAPERS PUBLISHED IN SCIENTIFIC JOURNALS Final Technical Report
David A. Sachs 31 Aug. 1971 11 p
(Contract N00014-70-C-0080)
(AD-730715; U-376-222) Avail: NTIS CSCL 20/1

In media for which the speed of sound is position dependent, propagating sound will be refracted and, in some cases, focused. In the focusing regions, usually referred to as caustics or convergence zones, significant amplification of the pressure levels above those predicted by spherical spreading has been observed for continuous waves as well as explosive pulses. In addition, the waveforms of explosive pulses undergo drastic distortion. In order to obtain a theoretical understanding of the behavior of shockwaves at caustics, an asymptotic theory of the refraction and focusing of sound originating from a point source in a stratified medium has been developed. The titles and abstracts of the technical reports, informal memoranda, and journal publications generated in the course of this development are listed. Topics covered in these reports include: the formulation of the Caustic Boundary Layer (CBL) theory of sound focusing, the phase shifts of harmonic waves at caustics, a comparison of the CBL theory's predictions with experiment, the development of higher order correction terms in the CBL theory and their application as criteria for the validity of the theory, the theory of lateral (precursor) waves associated with the CBL theory and ray theory and the extension of ray acoustics into caustic-related shadow zones. In addition, abstracts are given of two earlier reports concerned with the interaction of shockwaves with various types of boundaries.
Author (GRA)

N72-15637# State Univ. of New York at Buffalo. Dept. of Engineering Science.
AN INTEGRAL EQUATION FORMULATION OF ACOUSTIC FLUID ELASTIC SHELL DYNAMIC INTERACTION PROBLEMS
Richard P. Shaw Sep. 1971 43 p refs
(Contract N00014-71-C-0108)
(AD-731049; Rept-61) Avail: NTIS CSCL 20/1

A method is proposed for the study of the dynamic response of elastic shells submerged in a fluid medium. The method allows for shells of arbitrary thickness and arbitrary geometry to be described by exact equations of three dimensional elasticity, i.e. without the physical approximations of shell theory, while maintaining a reduction to a two dimensional variable field - the standard reason for employing shell theory. In addition, the infinite domain of the surrounding fluid medium is reduced to consideration of the two dimensional variable field at the shell-fluid interface. The method is based on an integral equation formulation equivalent to the usual wave equations governing this problem. Two problems are solved by this approach to illustrate its use and compare it to standard separation of variables techniques. First, a spherical shell of constant thickness surrounded by an infinite fluid is subjected to a time harmonic internal pressure. Then the same geometry with zero internal pressure is taken to scatter a plane time harmonic incident pressure wave.
Author (GRA)

N72-15638# State Univ. of New York at Buffalo. Dept. of Engineering Science.
AN INTEGRAL EQUATION FORMULATION OF DYNAMIC ACOUSTIC FLUID - ELASTIC SOLID INTERACTION PROBLEMS Summary Report
Richard Paul Shaw May 1971 38 p refs
(Contract N00014-71-C-0108; NR Proj. 064-481)

(AD-731046; Rept-60) Avail: NTIS CSCL 20/1

The interactions of waves traveling in an acoustic medium with an elastic obstacle (or vice versa) is studied by a formulation which has been useful in previous acoustic and representation of wave problems and has the advantage of involving only boundary (i.e., interface) values of the unknowns thus reducing the dimensionality of the problem. A simple example of plane wave scattering is included as an illustration for both time harmonic and transient cases. Author (GRA)

N72-15639# State Univ. of New York at Buffalo. Dept. of Engineering Science.

TRANSIENT ACOUSTIC SCATTERING BY A FREE (PRESSURE RELEASE) SPHERE Summary Report

Richard P. Shaw and James A. English 6 Jun. 1971 24 p refs

(Contract N00014-71-C-0108)

(AD-731047; Rept-56) Avail: NTIS CSCL 20/1

The transient scattering of plane and spherical acoustic pulses by a pressure release spherical surface is studied by means of a Kirchhoff integral formulation. Results are compared to modal solutions and show improvement in early time response calculations. Author (GRA)

N72-15640# Ballistic Research Labs., Aberdeen Proving Ground, Md. Signature and Propagation Lab.

MEASUREMENTS OF THE BEAM WANDER PHENOMENON IN A TURBULENT MEDIUM

Ernest C. Alcaraz and Peter M. Livingston Jun. 1971 19 p refs

(RDT/E Proj. 1T0-61101-A-91-A)

(AD-730644; BRL-MR-2103) Avail: NTIS CSCL 20/6

A collimated He-Ne laser beam at 6328 A was used to investigate the beam-wander phenomenon over a horizontal near-earth atmospheric path. Data were taken during lapse, neutral, and inversion conditions during the fall of 1969 at ranges from 350 m to 1.4 km. The total beam image at the receiver was photographically recorded at 32 frames/sec at an exposure of 1/600 sec; subsequently, each frame was scanned to find the center of energy of the beam's image. Simultaneously with the optical experiment, the wind velocity was determined at several points along the optical path to estimate the homogeneity of meteorological conditions and high-speed thermometry was used to determine the thermal structure coefficient, CT. Statistical computations and spectral analysis of the beam's center-of-energy motion and its correlation with measured meteorological quantities have been performed. Comparisons of these results with first-order theory and the wave-front angle-of-arrival problem will be presented. Author (GRA)

N72-15036*# Scripta Technica, Inc., Washington, D.C.

LIGHT AND COLOR THRESHOLDS OF LIGHTS AGAINST A BACKGROUND OF DIFFERENT BRIGHTNESS

R. L. Folb and S. V. Voronina *In its* Probl. of Physiol. Optics, Vol. 15 Nov. 1971 p 54-60 refs (See N72-15028 06-04)

Avail: NTIS CSCL 20F

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N72-15641 National Lending Library for Science and Technology, Boston Spa (England).

SUPERHEAVY ELEMENTS: EXTENSION OF THE PERIODIC SYSTEM

W. Greiner 16 Oct. 1971 20 p refs Transl. into ENGLISH from Umschau Wiss. Tech. (Frankfurt am Main), v. 69, no. 12, 1969 p 365-372

(NLL-AERE-Tr-1139) Copyright. Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A theoretical discussion is presented of the properties, production, and applications of elements with much heavier nuclei than that of element 104. The components of the effective ion-ion potential are described, along with the possibility of attaching heavy nuclei to stable elements to produce nuclei near element 114, such as Cm-248 + Ar-40 and Cm-248 + Ca-48. The lifetimes of the superelements are predicted, and multiple fission and its extension to cosmology are considered. The physics of very heavy ions, and heavy ion channelling in solid state physics are discussed. Experiments using cyclotrons and helical linacs to produce heavy ions are also mentioned. N.E.N.

N72-15642# Montpellier Univ. (France). Dept. de Physique Mathematique.

POSITIVE KAON PHOTOPRODUCTION: LOW ENERGY DESCRIPTION AND DUALITY RELATIONS

Y. Renard Jul. 1971 60 p refs

(PM/71/6) Avail: NTIS

An analysis of the reactions gamma + p yields K(+) + Lambda hyperon and gamma + p yields K(+) + Sigma(0) hyperon is performed for photon energies from threshold up to 1850 Mev. An isobaric model was used including Born terms and s- and u- channel resonances with the help of relativistic invariant and gauge invariant couplings and propagators. The fits to the experimental datas are optimized by minimizing the usual chi square; the parameters being the coupling constants. A comparison of low energy and high energy is made on the imaginary part of the four helicity amplitudes and on the effective trajectories in the sense of the FESR averaging; the high energy amplitude is taken from the model proposed by Capella and Tran and based on the K* - K** exchange degeneracy and the presence of a weak K*-Pomeron cut. In the case of gamma + p yields K(+) + Lambda hyperon it is shown that low energy amplitude reproduces well in average, with the features of the high energy one. Author

N72-15643# Nihon Univ., Tokyo (Japan). Dept. of Physics.

ON THE INTERACTION OF EXTENDED PARTICLES FORMULATION OF BREAKING AND CONNECTION OF STRINGS

Tetsuo Goto 1971 31 p refs

(NUP-A-71-15) Avail: NTIS

Interaction in the hadron string model was studied, assuming that the interaction occurs through breaking and connection of strings. Its mathematical formulation is shown to be possible, and a simple scattering amplitude can be calculated. Veneziano amplitude can be obtained in the special case where one of two strings produced in the breaking process has an infinitesimally small length. Author

N72-15644*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DYNAMIC NUCLEAR POLARIZATION IN SAMARIUM DOPED LANTHANUM MAGNESIUM NITRATE Ph.D. Thesis - Va. Polytechnic Inst.

Charles E. Byvik Sep. 1971 86 p refs

(NASA-TM-X-67592) Avail: NTIS CSCL 20H

The dynamic nuclear polarization of hydrogen nuclei by the solid effect in single crystals of samarium doped lanthanum magnesium nitrate (Sm:LMN) was studied theoretically and experimentally. The equations of evolution governing the dynamic nuclear polarization by the solid effect were derived in detail using the spin temperature theory and the complete expression for the steady state enhancement of the nuclear polarization was calculated. Experimental enhancements of the proton polarization were obtained for eight crystals at 9.2 GHz and liquid helium temperatures. The samarium concentration ranged from 0.1

percent to 1.1 percent as determined by X-ray fluorescence. A peak enhancement of 181 was measured for a 1.1 percent Sm:LMN crystal at 3.0 K. The maximum enhancements extrapolated with the theory using the experimental data for peak enhancement versus microwave power and correcting for leakage, agree with the ideal enhancement (240 in this experiment) within experimental error for three of the crystals. Author

N72-15645# Oslo Univ. (Norway). Inst. of Physics.
SIZE DISTRIBUTION OF ION CLUSTERS ALONG CHARGED PARTICLE TRACKS IN GASES
Aadne Ore [1970] 18 p refs
Avail: NTIS

The discrepancy that exists between the much-used relative frequencies observed by Wilson and by Beekman, respectively, for radiation-induced ion clusters containing various numbers of ion pairs per cluster, is discussed. A presumed difference in the influence of the merging by diffusion of adjacent clusters offers a quantitative explanation of this discrepancy. This conclusion supports the previous findings of Ore & Larsen, who based their overlap-correction procedure on a somewhat less sophisticated theoretical model. Author

N72-15646# Nice Univ. (France). Lab. de Physique Theorique.
TESTS OF THE EQUAL PHASE ASSUMPTION IN DOUBLE RESONANCE PRODUCTION
J. T. Donohue and G. Plaut Jan. 1972 9 p refs
(N-TH-72/2) Avail: NTIS

A set of (2 J sub 1 + 1)squared tests are proposed for the hypothesis that all helicity amplitudes in a quasi-two-body reaction have the same phase. The tests state that certain bilinear forms in the observable statistical tensors must vanish. The tests may be applied to experiments done on an unpolarized target for which no weak parity-violating decays are observed. Author

N72-15647*# Pittsburgh Univ., Pa. Dept. of Physics.
ELECTRON-IMPACT EXCITATION OF NITRIC OXIDE
E. J. Stone and E. C. Zipf Oct. 1971 26 p refs Submitted for publication
(Grant NGL-39-011-030)
(NASA-CR-125421; SRCC-161) Avail: NTIS CSCL 20H

The absolute cross sections for the excitation of the NO(+) bands, two nitric oxide beta' bands, and several atomic nitrogen multiplets in the vacuum ultraviolet by electron impact on NO were measured over an energy range extending from threshold to 3000 eV. The variation of the dipole transition moment for the NO(+) band system was also determined. Author

N72-15648# Oak Ridge Gaseous Diffusion Plant, Tenn. Isotopic Analysis Dept.
MASS SPECTROMETER ANALYSIS OF NEON ISOTOPES
J. C. Horton, A. Langdon, and C. Sulfridge 13 Aug. 1971 10 p refs Sponsored by AEC
(Contract W-7405-eng-26)
(K-1818) Avail: NTIS

A 6-in.-radius, 60 deg sector, dual-collector mass spectrometer was modified for precise ratio measurements of neon isotopes. A bellows was attached to the manifold to regulate the sample pressure behind the leak and thus avoid leak adjustments between samples being compared. An expanded-scale meter was added to the dc amplifier to facilitate precise setting of the ion beam intensity by regulating the manifold pressure with the bellows. With ratios of isotopic ratios of 1.04, the standard deviation of a single determination was ±0.0001. Author (NSA)

N72-15649# Scripps Institution of Oceanography, San Diego, Calif.
MEASUREMENTS OF BOMB PRODUCED RADIOCARBON IN THE SURFACE AND SUBSURFACE WATER OF THE PACIFIC OCEAN Interim Progress Report, 1 Mar. 1970 - 28 Feb. 1971
Hans E. Suess and George S. Bien 1 Mar. 1971 17 p refs Sponsored by AEC
(Contract AT(04-3)-34)
(UCSD-34-P-163-X-2) Avail: NTIS

Data tabulations are presented for the C-14 content in seawater samples collected from surface and subsurface waters of the Pacific Ocean. NSA

N72-15650# Atomic Energy Commission, Washington, D.C. Div. of Operational Safety.
SUMMARY INFORMATION ON ACCIDENTAL RELEASES OF RADIOACTIVE EFFLUENT TO THE ATMOSPHERE FROM UNDERGROUND NUCLEAR DETONATIONS DESIGNED FOR CONTAINMENT, 5 AUGUST 1963 - 30 JUNE 1971
Robert E. Allen Jun. 1971 28 p refs
(WASH-1183) Avail: NTIS; SOD $0.35 as 5210-0273

Information is presented concerning 17 nuclear tests that inadvertently released sufficient radioactivity to the atmosphere to be detected by ground monitors or ground monitoring equipment off the testing site. Topics considered include depth of burial, quantity of radioactivity released to the atmosphere, types of radionuclides identified in the release, highest air concentrations and gamma exposure levels detected in the offsite area, highest levels of radioiodine detected in milk, and thyroid dose when sufficient radioiodine was detected. NSA

N72-15651# Sandia Labs., Albuquerque, N.Mex.
NEUTRON INDUCED DEGRADATION AND FAILURE IN HIGH POWER LSA DIODE OSCILLATORS
W. E. Wilson and B. L. Gregory [1971] 10 p refs
(SC-DC-70-5386) Avail: NTIS

The effects of neutron irradiation on oversized epitaxial gallium arsenide diodes operated in the LSA relaxation mode are discussed. The expected material degradation effects are related to circuit performance by use of a simplified circuit analysis which neglects starting and harmonic effects. The experimentally determined material and oscillator characteristics are reported for diodes having two different initial doping concentrations. These results are compared to theory and general conclusions about the radiation effects on LSA oscillators. NSA

N72-15652# Oak Ridge National Lab., Tenn.
ISOTOPE KILOWATT PROGRAM Quarterly Progress Report, period ending 30 Jun. 1971
A. P. Fraas and G. Samuels Aug. 1971 20 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3491) Avail: NTIS

Progress, covering the organic systems, thermoelectric systems, thermal fuses and insulation, and heat block shield tests, is reported for the Isotope Kilowatt Program. E.H.W.

N72-15653# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
NEUTRON SOURCES AND APPLICATIONS
Apr. 1971 289 p refs Proc. of the Am. Nucl. Soc. Natl. Topical Meeting, Augusta, Ga., 19-21 Apr. 1971
(Contract AT(07-2)-1)
(Conf-710402-Vol-2) Avail: NTIS

A variety of subjects is discussed during the conference on neutron sources and applications. Reported studies range from neutron activation analysis in forensic medicine to neutron dose calculations in radiation therapy and to reactor and neutron physics of neutron generation. G.G.

N72-15654# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
REPRODUCIBILITY AND ACCURACY IN MASS-SPECTROMETRIC ANALYSES OF URANIUM COMPOUNDS

BY THERMAL IONIZATION
F. Siciliano and V. Fedeli 30 Nov. 1970 19 p refs
(RT/CHI(70)45) Avail: AEC Depository Libraries

The reproducibility problem for the isotopic ratio determination, and calibration and available accuracy linked to many parameters involved with thermal ionization source mass spectrometers are discussed on a semiquantitative basis. The results of NBS standards are also given. The uranium isotopic ratios determined R sub 58 is less than 1 are in the same order of magnitude of the uranium isotopic ratios (R sub 5x) (X = 3, 6, 8, i.e., U-233, U-236, U-238) of fuel elements samples that will be reprocessed. Author (NSA)

N72-15655# Commissariat a l'Energie Atomique, Grenoble (France).
ESR AND ENDOR STUDY OF THE HYDROGEN BOND PROPERTIES. BEHAVIOR OF THE GAMMA INDUCED RADICALS IN HYDROGEN BONDED CRYSTALS HAVING PROTONIC CONDUCTIVITY: IMIDAZOLE AND TRIAZOLE
P. Gloux and B. Lamotte 1970 4 p refs
(CEA-CONF-1763; Conf-700960-2) Avail: AEC Depository Libraries

By gamma irradiation of imidazole and triazole, three free radicals corresponding to the addition of a hydrogen atom on aromatic carbons were obtained. All the proton hyperfine tensors of the radicals were determined using ENDOR measurements at 100 K (type (a) protons, covalently bonded to the free radicals; type (b) protons, hydrogen bonded to the free radicals). ENDOR spectroscopy allows type (b) protons to be determined. NSA

N72-15656# Wisconsin Univ., Madison.
NEW APPROACHES FOR FAST NEUTRON SOLID STATE DOSIMETRY
P. R. Moran and J. R. Cameron [1970] 12 p refs Presented at Symp. on New Develop. in Phys. and Biol. Radiation Detectors, Vienna, Austria, 23 Nov. 1970
(COO-1105-167; Conf-701112-4) Avail: NTIS

The basic experimental problems related to the detection of radiation damage centers are reviewed; an upper bound on radiation induced defect center concentrations in solids is estimated. Intrinsic instabilities in probe sources and fluctuations in sample properties imply that only nonsubtractive detection methods promise to achieve the sensitivities required for personnel dosimetry. Some examples of nonsubtractive optical detection techniques which were successfully exploited in other high sensitivity applications are discussed, and some classes of hydrogen-rich solids which appear to have the solid state physics properties desirable for dosimetric applications are suggested. Among the optical methods worthy of investigation are: photoexcitation fluorescence, photoconductivity, excitonic phosphorescence, Rayleigh scattering, and Raman scattering. NSA

N72-15657# Central Lab. for Radiological Protection, Warsaw (Poland).
THE CALCULATION OF THE RELATIVE CONCENTRATION OF THE RADIOACTIVE PARTICLES FALLING ON THE EARTH'S SURFACE
Ludwika Kownacka 1971 24 p refs In POLISH
(CLOR-83/D) Avail: AEC Depository Libraries

The calculations were based upon a simple linear model of radioactive cloud whose size and maximum height in the atmosphere is a function of explosion yield. Particle size distribution in the cloud was determined by the log-normal function, and their fallrates were calculated by various methods depending on their respective size. The particle size distribution on the ground as the function of the distance from the source was calculated by assuming the wind velocity is a linear function of the height. Six equations were obtained for determining the relative concentration of the particles on the earth's surface. A GIER computer was used for the numerical calculations for the low yield explosions that produced clouds in the trophosphere and for the distances covered by the local fallout. Curves of the size distribution of the particles for several distances and explosion yield are presented. Significant differences in the particle size distribution for different explosion yields were found. Author (NSA)

N72-15658# Institut d'Astrophysique, Paris (France).
ON THE NUCLEON-ANTINUCLEON ANNIHILATION COEFFICIENT
S. M. V. Aldrovandi and J. L. Puget 1971 33 p refs Submitted for publication Sponsored in part by ESRO and Fundacao de Amparo a Pesquisado Estado
Avail: NTIS

The mean value of the annihilation cross section is calculated for different processes of proton-antiproton annihilation, over a large range of temperature. The mechanisms considered are annihilation in flight and annihilation from a proton-antiproton bound state created by means of radiative capture or three body recombination collision or atomic collisions. The annihilation and radiative cascade probabilities in protonium are also studied. Author (ESRO)

N72-15659# Rome Univ. (Italy). Inst. of Physics.
THE ELECTROPRODUCTION OF PIONS
E. Amaldi 11 Jan. 1971 57 p refs Presented at the Meeting on Electrosynchrotron, Frascati, Italy, 5-7 Nov. 1970
(Nota-Interna-299) Avail: NTIS

The experimental and theoretical knowledge on electroproduction of positive and neutral pions at very low energy, in particular near threshold, is summarized. The kinematical nature is introduced, the general expression for the cross section, derived under the assumption of a single photon exchange, is given, and the main lines of the various theoretical approaches are described. Coincidence experiments and the result of their analysis are discussed. Author (ESRO)

N72-15660# Rome Univ. (Italy). Inst. of Physics.
REMARKS ON INCLUSIVE EXPERIMENTS AND HIGH ENERGY MODELS
C. Boldrighini, L. Lusanna (Padua Univ.), and L. Sertorio 2 Apr. 1971 13 p refs
(Nota-Interna-310) Avail: NTIS

Multiperipheral models (MPM), multi-Regge models (MRM), and dual models are discussed along with the connection between the symptotic behavior and the average multiplicity and average perpendicular momentum. ESRO

N72-15661# Rome Univ. (Italy). Inst. of Physics.
EXPLICIT EXPRESSIONS OF THE POTENTIAL AND ITS DERIVATIVES AT THE ORIGIN IN TERMS OF THE SCATTERING DATA
F. Calogero 11 May 1971 77 p refs Presented at the Workshop on Math. of Profile Inversion, NASA, Ames Res. Center, Moffet Field, Calif., 12-16 Jul. 1971
(Nota-Interna-316) Avail: NTIS

A theory was developed for quantum mechanical scattering of a particle by a spherically symmetrical potential field. Inverse scattering is considered; input consisted of scattering and bound-state data. The results are explicit expressions for the values of the potential and its derivatives at the origin. Various methods of solution are outlined. The simplest scattering problem (nonrelativistic S-wave scattering on a holomorphic potential field without bound states) was used as the basis for discussion. A compilation of previous research data in this field is reported, including the treatment of higher partial waves, and of the Klein-Gordon and Dirac equations. Author (ESRO)

N72-15662# Philipps-Universitat, Marburg (West Germany).
DESCRIPTION PROBLEMS OF MATTER AND ANTIMATTER IN THE RELATIVISTIC FIELD THEORY Inst. fuer Theoretische Physik. [PROBLEME DER BESCHREIBUNG VON MATERIE UND ANTIMATERIE IN DER RELATIVIS-

TISCHEN FELDTHEORIE]
J. Petzold and B. Gerlach Bonn Bundeswehramt 1971 22 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-71-15) Avail: NTIS; Bundeswehramt: 25 DM

Antiparticles are created artificially, using relativistic particles. A relativistic quantum field theory is described, examining various equations in order to eliminate the severe inconsistencies in the theory. Author (ESRO)

N72-15663# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
EXPERIMENTS IN NUCLEAR PHYSICS USING BEAM PULSING AND TIME OF FLIGHT SYSTEMS Final Technical Report
Kenneth H. Purser 1971 46 p
(Contract AF 49(638)-1707; AF Proj. 9751-02)
(AD-731120; AFOSR-TR-71-2652; Rept-6144501F; Rept-681301) Avail: NTIS CSCL 20/7

The contract supported a program for the installation and use of Time-of-Flight facility. The report described the major features of the work done during the period on the pulsed beam project. It can be divided into three major sections: A description of the pulsed beam facility and the features of its design; The experimental program and results ; An attempt to study damage effects in calcogenous glasses. Author (GRA)

N72-15413# Joint Publications Research Service, Washington, D.C.
ON THE POSSIBILITIES OF USING NUCLEAR MAGNETIC RESONANCE FOR THE ELEMENTARY ANALYSIS OF MATTER
A. M. Sazonov *In its* Magnetometry 17 Dec. 1971 p 33-45 refs (See N72-15408 06-14)
Avail: NTIS

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N72-15664 National Lending Library for Science and Technology, Boston Spa (England).
TURBULENCE AND HEATING IN A PLASMA CARRYING A TRANSVERSE CURRENT
V. V. Demchenko, V. L. Sizonenko, and K. N. Stepanov 15 Oct. 1971 16 p refs Transl. into ENGLISH from Inst. of Applied Phys. report KhFTI-70-62, Kharkov, 1970
(NLL-CTO-770-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Estimates are given for the magnitude of the turbulent fluctuations of density and velocity of electrons and ions and of the electric field in a plasma carrying a current at right angles to the magnetic field. An estimate is made of the cross-section for Raman scattering of microwaves by turbulent fluctuations of the electron density, and the values obtained are compared with the experimental results. It is shown that in such a plasma there exists an effective mechanism for the heating of non-resonance ions, due to the finite correlation time of the electric field fluctuations. Author

N72-15665*# Rensselaer Polytechnic Inst., Troy, N.Y. Plasma Dynamics Lab.
INSTABILITIES AND TURBULENCE IN HIGHLY IONIZED PLASMAS IN A MAGNETIC FIELD Semiannual Status Report
J. H. Noon and W. C. Jennings Nov. 1971 73 p refs
(Grant NGR-33-018-137)
(NASA-CR-124634; TR-71-3) Avail: NTIS CSCL 20I

Experimental and theoretical work has been extended on the physical mechanisms of plasma turbulence and coherent instabilities. Turbulence is described in terms of parametric effects and experimental and theoretical results show that energy is transferred in both directions of the frequency spectrum. Energy transfer to higher frequencies results in turbulence acting as a safety valve against the growth of coherent, low frequency instabilities. Energy transfer to lower frequencies results in anomalously high diffusion rates. A linear theory has been applied to the drift instability in the Rensselaer HCD and reasonable agreement between predictions and experimental results has been obtained. Author

N72-15666*# California Univ., Los Angeles. Plasma Physics Group.
ELECTROMAGNETIC PLASMA WAVE PROPAGATION ALONG A MAGNETIC FIELD Ph.D. Thesis
Craig Lee Olson Jun. 1970 264 p refs
(Grant NGR-05-007-190; Contract AT(04-3)-34; Grants N00014-69-A-0200-4023; NSF GP-6817)
(NASA-CR-125416) Avail: NTIS CSCL 20I

The linearized response of a Vlasov plasma to the steady-state excitation of transverse plasma waves along an external magnetic field is examined. Assuming a delta-function excitation mechanism, and performing a detailed Vlasov-Maxwell equation analysis using Fourier-Laplace transforms, the plasma response is found to consist of three terms: a branch-cut term, a free-streaming term, and a dielectric-pole term. Also considered is the phenomenon of plasma wave echoes. The case of longitudinal electrostatic waves is extended to the case of transverse plasma waves that propagate along an external magnetic field. It is shown that a transverse echo results in lowest order only when one excitation is transverse and the other is longitudinal. Author

N72-15667# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
PARTICLE CONTAINMENT IN MIRROR TRAPS IN THE PRESENCE OF FLUCTUATING ELECTRIC FIELDS
R. E. Amodt Apr. 1971 12 p refs
(Contract AT(11-1)-2081)
(COO-2081-3) Avail: NTIS

Particle motion in MHD stable magnetic mirrors and the high frequency electric fields characteristic of the collective modes of such a system is shown to be restricted by two simple constraints. These constraints, which reduce to the usual magnetic moment and kinetic energy in the absence of fluctuating fields, dictate that while even small amplitude waves induce large magnetic moment excursions, the particle containment properties of the trap are not greatly reduced by the fluctuations. Author (NSA)

N72-15668# Los Alamos Scientific Lab., N.Mex.
PERHAPSATRON S-5 AND S-5 ZEUS EXPERIMENTS REVIEWED IN LIGHT OF CURRENT TECHNOLOGY
J. A. Phillips Mar. 1971 14 p refs
(Contract W-7405-eng-36)
(LA-4664) Avail: NTIS

These two experiments were the last in a series of perhapsatrons in which stabilization of the pinch was attempted by the inclusion of a longitudinal B sub z magnetic field and a close conducting wall. The data are discussed in terms of present understanding of the stable diffuse pinch. Author (NSA)

N72-15669# Sydney Univ. (Australia). School of Physics.
WILLS PLASMA PHYSICS DEPARTMENT Semiannual Progress Report, 1 Jan. - 30 Jun. 1971
Jun. 1971 11 p refs
(NP-18963; SAPR-21) Avail: AEC Depository Libraries

Plasma physics work undertaken by the department is briefly summarized under the headings: (1) plasma sources; (2) hydromagnetic ionizing fronts; (3) hydromagnetic waves; (4) laser diagnostics; (5) plasma decay in SUPPER I; (6) cyclotron harmonic waves in SUPPER V; and (7) far-infrared. Recent staff publications are listed. NSA

N72-15670# Techtran Corp., Glen Burnie, Md.
MEASUREMENT OF THE DIFFUSION LIFETIME OF THE PLASMA IN THE TOKAMAK-3 MACHINE BY THE INJECTION OF NEUTRAL HYDROGEN
E. P. Gorbunov, S. V. Mirnov, and D. S. Parfenov Jul. 1971 26 p refs Transl. into ENGLISH from Inst. Atomnoi Energii, Moscow, Rept. no. IAE-2064 Prepared for Princeton Univ., N.J.
(Contract AT(30-1)-1238)
(MATT-Trans-106; IAE-2064) Avail: NTIS

Experiments are described that deal with the impulse injection of a neutral gas during the discharge process in the Tokamak-3 machine. Measurement of the electron concentration was carried out by multichord probing with 2-mm waves. The flux of neutral gas from the chamber walls and from the diaphragm was determined from measurements in three directions of the intensity of a hydrogen spectral line. The diffusion lifetime lies within the limits 20 to 30 msec, and the cessation of the drop in electron concentration in the middle stage of the discharge is not associated with an increase in the flux of neutral gas but with the improvement in containing the plasma. The fluxes from the diaphragm and the chamber walls are compared. The diffusion and energy times are contrasted. Author (NSA)

N72-15671# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
MIRROR CONTAINMENT WITH LOW FREQUENCY SHORT-WAVE LENGTH FLUCTUATIONS
R. E. Aamodt Jun. 1971 8 p refs
(Contract AT(11-1)-2081)
(COO-2081-4) Avail: NTIS

Low frequency fluctuations having long wavelengths along, and arbitrary wavelengths in one direction perpendicular to, an external magnetic mirror field are shown to only weakly affect particle containment in the mirror trap. It is shown that a critical level of fluctuations exists, below which essentially no losses occur, and above which nonexpandable, nonlinear transitions in phase space induce only weak diffusion. Author (NSA)

N72-15672# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
TOKAMAK BIBLIOGRAPHY
B. J. Green, comp. Mar. 1971 124 p refs
(IPP-6/93) Avail: AEC Depository Libraries

This listing includes 604 references on the following: dynamic equilibrium and stability, feedback stabilization, toroidal confinement, diagnostics, plasma injection, plasma heating, transport processes, z pinches, and fast toroidal pinches. NSA

N72-15673# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
DETERMINATION OF THE PRODUCTS FROM ELECTRON DENSITY AND MAGNETIC FIELD IN A SMALL THETA PINCH BY POLARIMETRY AT 633 NM
E. Glock Apr. 1971 35 p refs In GERMAN
(IPP-1/116) Avail: AEC Depository Libraries

The product of electron density and axial magnetic field in a 5-kJ theta pinch was measured by the Faraday rotation of a He-Ne laser beam at 633 nm. With 10-mW laser output at disposal and approximately 20 ns rise time in the detector channel, a signal-to-noise ratio of unity was attained with n sub e x B x 1 = 10 to the 21st power Gauss x sq/cm, corresponding, e.g., to 100 Gauss in 1-m coil length with N sub e = 10 to the 17th power cu/cm. The measurements are consistent with supplementary flux measurements and smear photographs. Some of the ideas prevailing about the phenomena in a theta pinch could not be confirmed. Author (NSA)

N72-15674# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
REMARK ON TRAPPED PARTICLE PINCH IN A TOKOMAK
H. M. Mayer and S. Puri Mar. 1971 7 p refs
(IPP-4/20) Avail: AEC Depository Libraries

Trapped particle pinch in a Tokamak is shown to be directly related to flux surface concentration. Study of flux surface motion allows an accurate estimate of particle drift in arbitrary axisymmetric geometries. The trapped particle pinch velocity is compared with the numerical computation of the particle trajectory in a Levitron. Author (NSA)

N72-15675# Academy of Sciences (USSR), Moscow. Inst. Fiziki.
THEORETICAL AND EXPERIMENTAL STUDIES OF DIRECT, HIGH CURRENT DISCHARGES IN VACUUM
A. F. Aleksandrov, V. V. Zosimov, A. A. Rukhadze, V. I. Savoskin, and A. A. Timofeev Jun. 1971 51 p refs In RUSSIAN
(NP-18972; Preprint-72) Avail: AEC Depository Libraries

High-current discharges can be used as powerful sources of radiation for pumping lasers (optical quantum generators). These discharges can be divided into two classes: (1) vacuum discharges, and (2) high-current discharge in a gaseous medium such as is caused by passing a high current through a thin metal wire. The theory is developed for the equilibrium distribution of density, velocity, magnetic field and temperature in transparent, nontransparent, and gray discharges. Confirmation of the theoretical conclusions was sought and found by taking spectral measurements on plasmas formed by exploding silver wires electrically in quartz vessels. NSA

N72-15676# California Univ., Livermore. Lawrence Radiation Lab.
COMPUTATIONAL PROBLEMS IN MAGNETOHYDRODYNAMICS
John Killeen 8 Feb. 1971 44 p refs Presented at the IFIPS Congr., Ljubljana, Yugoslavia, Aug. 1971 Sponsored by AEC
(UCRL-73038; Conf-710805-2) Avail: NTIS

A number of numerical methods useful in solving the equations of magnetohydrodynamics are reviewed. The problems that are considered arise in the physics of ionized gases as applied to the controlled thermonuclear research program. Similar problems occur in astrophysics, space science, and geophysics. Initial value problems in one and two dimensions are considered first. A survey is given of both explicit and implicit finite difference schemes that are used to solve these problems. The models include both hyperbolic and parabolic systems of differential equations. Time-independent problems are also considered which involve the numerical solution of plasma equilibria in complicated magnetic field configurations. These nonlinear elliptic equations in two and three dimensions are solved by iterative methods which are described. Author (NSA)

N72-15677# Princeton Univ., N.J. Plasma Physics Lab.
[TOROIDAL RESEARCH, THEORETICAL PHYSICS PROGRAM, AND BASIC PLASMA EXPERIMENTS] Annual Report, 1 Jan. - 31 Dec. 1970
Jul. 1971 139 p refs
(AT(30-1)-1238)
(MATT-Q-28) Avail: NTIS

Progress is reported on the model ST Tokamak, levitated superconducting-ring spherator, the FM-1 spherator, and an adiabatic toroidal compression experiment. The theoretical program is reviewed and divided into four sections: (1) the theory of Tokamaks and stellarators, (2) basic plasma physics, (3) computer simulation of plasmas, and (4) astrophysics. Plans for ion cyclotron heating and lower hybrid heating on the ST Tokamak are discussed. Small machine experiments are given for magnetic pumping with a strong spatial gradient, of parametric heating near the electron plasma frequency, and of a RF ion source. Experiments were also carried out on small linear Q machines to study feedback stabilization, anomalous resistivity, nonlinear wave-wave and wave-particle scattering, the approach of an unstable plasma to the quasi-linear steady state, the Kelvin-Helmholtz instability, and current driven drift waves.
J.A.M.

N72-15678# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
STATIONARY, ADIABATIC PLASMA FLOW IN THE MAGNETOSPHERE
Erik T. Karlson 19 May 1971 26 p refs Presented at the Advan. Study Inst. on Magnetosphere-Ionosphere Interactions, Dalseter, Norway, 14-23 Apr. 1971
(TRITA-EPP-71-08) Avail: NTIS

Magnetospheric features in terms of stationary, adiabatic plasma flow are investigated. The energy distribution of the particles is simulated by two groups with different energy. In the first part, the flow in the magnetosphere is self-consistent in the sense that there is no exchange of charge between the magnetosphere and the ionsphere. It is shown that if the two groups are taken to represent a Maxwellian distribution of particle energies in the plasma sheet, a sharp inner edge of the plasma sheet will result. In the second part, the interaction of magnetospheric flow with the ionsphere is taken into account. It is pointed out that the self-consistent solution solves this problem also, for one extreme case, namely when there are longitudinal electric fields and no field-aligned currents.
Author (ESRO)

N72-15679# Royal Inst. of Tech., Stockholm (Sweden). Div. of Electron Physics.
THE GROWTH OF A SPACE CHARGE SHEATH IN A LOW DENSITY DISCHARGE PLASMA
S. Torven and M. Babic Sep. 1971 16 p refs
(Rept-71-20) Avail: NTIS

An experiment made in the positive column of a mercury arc investigated the conditions in the stationary plasma just before the sudden sheath growth. The surge voltage drops are found to be concentrated to a space charge sheath formed within the plasma. Apart from its technical consequences this phenomenon deserves attention, because the tendency to form space charge sheaths may be quite an ordinary property of cosmical plasmas. Author (ESRO)

N72-15680# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
DETERMINATION OF THE ELECTRON DENSITY AND TEMPERATURE OF A PLASMA BY THE APPLICATION OF LINE-BROADENING THEORY TO OBSERVED LINE PROFILES
Margaret Weston Jul. 1971 34 p refs
(NPL-QU-18) Avail: NTIS

The electron density in a plasma of a water-stabilized arc was determined by applying Griem and Kepple's theory of line broadening to observed experimental profiles of H beta and H gamma lines. From electron density data and application of the Saha equation, the arc temperature was calculated. These results were compared with those obtained by applying the Holtsmark line broadening theory. The development of the Griem theory from the Holtsmark theory is briefly sketched. Author (ESRO)

N72-15681# Princeton Univ., N.J. Plasma Physics Lab.
NONLINEAR INSTABILITY OF BERNSTEIN MODES PUMPED BY AN ELECTROMAGNETIC WAVE
R. N. Carlile Sep. 1971 30 p refs
(Contract N00014-67-A-0151-0021)
(AD-731067; PPL-NP7; Req-00173-9-006346/1-12-70) Avail: NTIS CSCL 20/9

The author has investigated, by means of computer experiments, the nonlinear decay instability of Bernstein modes pumped by an electromagnetic wave, and the subsequent heating of the plasma electrons. It was found that four pairs of Bernstein modes became unstable, and grew to large amplitudes. Each pair together with the electromagnetic wave satisfied the criteria for wave-wave interaction. The Bernstein modes would finally saturate. The kinetic energy of the plasma electrons would then begin to increase, and over the time the code was allowed to run, the electrons would have their energy increased by a factor of 4. Saturation occurred when the Coulomb force on a particle due to the electric field of the Bernstein mode became of the order of magnitude of the Lorentz force on that particle due to the DC magnetic field. The particle probably had its orbital motion destroyed and became trapped briefly in the potential wells of the Bernstein mode. Author (GRA)

N72-15682# Michigan Univ., Ann Arbor. Dept. of Mathematics.
MAGNETOHYDRODYNAMICS, PLASMAS, AND CONTROL THEORY Final Report, 1 Nov. 1968 - 31 Aug. 1971
Lamberto Cesari Sep. 1971 13 p refs
(Grant AF-AFOSR-1662-69; Af Proj. 9749)
(AD-731122; Rept-61102F; Rept-681304) Avail: NTIS CSCL 20/9

The document gives various papers done under contract on optimal control and plasma physics. GRA

N72-15683# Office of Naval Research, London (England).
PLASMA PHYSICS AT THE UNIVERSITY COLLEGE OF NORTH WALES, BANGOR
Alfredo Banos, Jr. 26 Jul. 1971 7 p refs
(AD-730451; ONRL-R-32-71) Avail: NTIS CSCL 20/9

The report gives an account of a liaison visit to the University College of North Wales in Bangor, where Professor T.J.M. Boyd, in scarcely two years after becoming Head of the Applied Mathematics Department, has strengthened his Department by providing energetic leadership in all sectors, and by creating with staff members already on hand, a Plasma Research Group that for its size and youth, is exemplary in its productivity and high quality of research. The report gives a summary account of the main six fields of plasma research now currently going on at Bangor. Author (GRA)

N72-15684# Naval Research Lab., Washington, D.C.
DEMONSTRATION OF COLLISIONLESS INTERACTIONS BETWEEN COUNTERSTREAMING IONS IN A LASER PRODUCED PLASMA EXPERIMENT Final Report
Stephen O. Dean 17 Sep. 1971 47 p refs
(HX Proj. 607.01)
(AD-731373; NRL-7301; NRL-H02-27B) Avail: NTIS CSCL 20/9

The width, time development, and ambient pressure dependence of a collisionless interaction front in a plasma were studied using fast photography, shadowgraphy, and electric potential probes. The object was to investigate the expansion of a laser-produced plasma through an ambient plasma, under conditions where the mean free path for binary momentum transfer collisions was larger than the total expansion radius. Sharp luminous fronts were observed with both framing and streak photography. The change in plasma radius with time was studied as a function of ambient nitrogen pressure. The dynamics of the situation were in good agreement with strong-momentum-coupling models (a radiation-driven detonation wave at early times, and a blast wave at later times). An electric potential in the front was measured, of sufficient magnitude to account for the observed late-time blast wave energies. Shadowgraphy showed that the front consisted of a shell of enhanced density, that the density gradients in the front depended on ambient pressure, and that the front width was of the order of a millimeter. A possible theoretical model for the collective effect necessary to account for the observed collisionless dissipation is the ion-ion two-stream instability in the presence of a magnetic field. Author (GRA)

N72-15685# Avco-Everett Research Lab., Everett, Mass.
RESEARCH ON ELECTRON RICH PLASMA STABILITY Final Scientific Report, 1 Apr. 1970 - 30 Apr. 1971
G. S. Janes May 1971 45 p refs
(Contract F44620-70-C-0067; Task-975201)
(AD-730606; AFOSR-71-2532TR) Avail: NTIS CSCL 20/9

The report presents the final results of studies on electron rich plasmas. Studies have been conducted on the production and containment of electron rich plasmas in toroidal geometries.

Electron densities in excess of 3 billion/cc have been produced and contained from as much as 10 milliseconds. Studies also indicate that the optimum production of large electron densities without excessive wall bombardment should be attained with a triode type injection configuration wherein the energy investment in waves and electron temperature is minimized. This configuration should be located near the major axis of the apparatus. Containment is terminated when the ion density reaches about 20 percent of the electron density. The ions are shown to be produced from atoms which are released from the walls by electron bombardment associated with inefficiencies in the electron injection process. A technique for controlling this effect which involves electron prebombardment of the walls is described. Author (GRA)

N72-15360# Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
THE STUDY OF PLASMA RESONANCES WITH A SINGLE ANTENNA
Michel Petit *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 249-257 refs (See N72-15339 06-13)
Avail: NTIS

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N72-15686 CEGB Information Services, London (England).
THE FLUX LINE SYSTEM OF AXIALLY MAGNETIZED CYLINDRICAL SUPERCONDUCTORS OF TYPE 2
U. Essmann and H. Traeuble [1971] 24 p refs Transl. into ENGLISH from Phys. Status Solidi (Berlin), v. 32, 1969 p 337-356
(NLL-CE-Tr-5192) Avail: Issuing Activity

The extreme cases of the flux line arrangement in real type 2 superconductors with high % are the periodic triangular lattice for high flux line densities and the flux line fluid for low flux line densities. Density and arrangement of the flux lines depend on the specimen radius vector; this is due to the presence of lattice defects in the super conducting material. The observed flux gradients are discussed in terms of a flux-line dislocation theory. The disorder in the flux line system increases with decreasing flux line density. The specimens investigated so far show a transition from the flux line lattice to a flux line fluid for flux line densities B sub loc< 30 G. This effect is attributed to the interaction between flux lines and pinning centers. The distance between isolated flux lines from the flux line system may be used to estimate the pinning forces in a fairly direct way.
Author

N72-15687 National Lending Library for Science and Technology, Boston Spa (England).
THE RANDOM MOVEMENT OF DISLOCATIONS IN THE CHRONOLOGICALLY PERIODIC STRESS FIELD
B. A. Vershok, V. I. Zhadan, and A. L. Roitburd 1971 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 14, no. 7, 1971 p 100-104
(NLL-M-21166-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A method is suggested for obtaining an approximate solution to integral and differential equations describing random, unrestricted movement in the periodic distribution of straight line dislocations considered as origins for vacant sites. An expression was obtained for the dislocation displacement, which is shown to be time-variable. Relaxation time is inversely proportional to the three-dimensional self-diffusion coefficient and directly proportional to the distribution of the dislocations. A qualitative account is presented for the fractional relationship between frequency and temperature in the high temperature internal friction region. Author

N72-15688*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAGNETOSTRICTION AND MAGNETOELASTIC QUANTUM OSCILLATIONS IN p-TYPE LEAD TELLURIDE
T. E. Thompson (Pa. Univ., Philadelphia), Paul R. Aron, B.S. Chandrasekhar (Case Western Reserve Univ.), and D. N. Langenberg (Pa. Univ., Philadelphia) Washington Jan. 1972 48 p refs Sponsored in part by Air Force and ARPA
(NASA-TN-D-6623; E-6524) Avail: NTIS CSCL 20L

A detailed experimental and theoretical study of quantum oscillations in the magnetostriction and Young's modulus of p-PbTe is presented. The valance band of PbTe is approximated by a spheroidal, nonparabolic model in which the effects of strain on the valance band parameters are described by a deformation potential model. Using appropriate thermodynamic derivatives of the modified Lifshitz-Kosevich expression for the oscillatory parts of the electronic free energy, it is shown that both types of oscillations arise mainly from relative shifts of the valance band maxima due to shear strains, accompanied by intervalley charge transfer. Band parameters derived from the periods, phases, and spin splitting of the oscillations are in generally good agreement with values reported by other workers. A detailed comparison is made of the experimentally observed oscillation amplitudes with those predicted by theory, and satisfactory agreement is found. The ratio of the amplitudes of the two effects yields a value of the valance band deformation potential in good agreement with a value found from piezoresistance experiments by Burke. Author

N72-15689*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REFRACTIVE INDEX AND BIREFRINGENCE OF 2H SILICON CARBIDE
J. Anthony Powell Washington Jan. 1972 18 p refs
(NASA-TN-D-6635; E-6476) Avail: NTIS CSCL 20L

The refractive indices of 2H SiC were measured over the wavelength range 435.8 to 650.9 nm by the method of minimum deviation. At the wavelength lambda = 546.1 nm, the ordinary index n sub 0 was 2.6480 and the extraordinary index n sub e was 2.7237. The estimated error (standard deviation) in the measured values is 0.0006 for n sub 0 and 0.0009 for n sub e. The experimental data were curve fitted to the Cauchy equation for the index of refraction as a function of wavelength. The birefringence of 2H SiC was found to vary from 0.0719 at lambda = 650.9 nm to 0.0846 at lambda = 435.8 nm. Author

N72-15690# Joint Publications Research Service, Washington, D.C.
DESCRIPTION OF SUPERCONDUCTIVITY IN TERMS OF THE DIELECTRIC RESPONSE FUNCTION
D. A. Kirzhnits, Ye. G. Maksimov, and D. I. Khomskiy 12 Jan. 1972 33 p refs Transl. into ENGLISH of "Opisaniye Sverkhprovodimosti Na Yazyke Dielektricheskoy Pronitsayemosti" Moscow, 1970 p 1-51
(JPRS-54922) Avail: NTIS

The critical temperature T sub c was computed for a superconductive transition under general assumptions regarding electronic interaction. The Coulomb interaction was calculated, and it is shown that with space and time dispersion taken into account, the contribution made by this interaction to the critical temperature is markedly reduced because of the known logarithmic factor. Two of the simplest models are considered in examples which illustrate the formulas obtained. Author

N72-15691# General Electric Co., Schenectady, N.Y. General Physics Lab.
IONIC TRANSPORT PHENOMENA IN SUPER IONIC CONDUCTORS: A THEORETICAL MODEL

M. J. Rice and W. L. Roth Jun. 1971 49 p refs
(Rept-71-C-180) Avail: NTIS

The model is based on the hypothesis that there exists in the ionic conductor an energy gap, above which ions belonging to the conducting species, can be thermally excited from localized ionic states to free-ion-like states in which an ion propagates throughout the solid. On account of the interaction with the rest of the solid, such an excited free-ion-like state is assumed to have a finite lifetime. On the basis of a postulated Boltzmann transport equation for the thermal occupations of the various free-ion-like states, simple expressions are derived for the ionic conductivity, thermal conductivity, and thermoelectric power. Author

N72-15692# Technische Hogeschool, Eindhoven (Netherlands).
ELECTRICAL TRANSPORT PROPERTIES OF THE SEMICONDUCTING LAYER COMPOUNDS GaS AND GaSe Ph.D. Thesis
Antoon Herman Maria Kipperman 1971 87 p refs
Avail: NTIS

Recent literature on optical measurement and transport properties of gallium sulfide and selenide is reviewed. Eight previously published articles on the two crystal compounds are included. These are discussed in relation to earlier literature, emphasizing the areas of electron and hole mobility, scattering, metal surface barriers, anisotropic conductivity, effective state density and effective electron mass, and photoconductivity. Band structure and dielectric properties of the two gallium compounds are also considered. K.P.D.

N72-15693# Atlantic Richfield Hanford Co., Richland, Wash. Separation Chemistry Lab.
SYSTEMATIC PEAK REDUCTION METHOD FOR SEMICONDUCTOR DETECTOR SPECTRA
W. H. Zimmer 15 Jan. 1971 20 p Sponsored by AEC
(ARH-1877; TID-4500) Avail: NTIS

The method described is designed for general analytical application and is easily programmed for utilization with small computers. The representative area of a spectral peak is established on the basis of the detector system resolution and the noise continuum level on each side of the peak, the latter being determined by a simple search routine. Specific comparisons of accuracy and precision are made to the total photopeak method of data reduction. Author (NSA)

N72-15694# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
STRUCTURE AND PROPERTIES OF SOLID SOLUTIONS Technical Progress Report, 1 Sep. 1970 - 15 Jun. 1971
D. A. Koss and A. A. Hendrickson Jun. 1971 14 p refs
(Contract AT(11-1)-916)
(COO-916-20) Avail: NTIS

Results of research on the nature of solid solution strengthening in fcc and bcc substitutional alloys are reported. The research is concerned with both an analysis of individual dislocation-defect interactions and the relation between dislocation behavior and macroscopic mechanical properties. Yield stress and stress-strain behavior of very pure substitutional alloy single crystals were investigated and observations of the motion and interaction of individual dislocations were made using etch pitting techniques. The results serve as a basis for understanding the mechanisms of solid solution hardening as well as serving as critical tests of current hardening theories. NSA

N72-15695# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris.
STUDY OF THE LUMINESCENCE BY ELECTRONIC BOMBARDMENT OF GALLIUM ARSENIDE Quarterly and Final Report [ETUDE DE LA LUMINESCENCE PAR BOMBARDEMENT ELECTRONIQUE DE L'ARSENIURE DE GALLIUM COMPTE RENDU TRIMESTRIEL NO. 4 RAPPORT FINAL]
P. Leclerc and P. Hirtz [1970] 50 p refs In FRENCH
Sponsored by Delegation Gen. de Rech. Sci. et Tech.
(QR-4) Avail: NTIS

In order to obtain more information on the nonequilibrium properties of gallium arsenides and to predict the quantity to be used for the electroluminescence study, a fast modulation electron gun was developed. Some experimental results, including durability of the transient signal, radiative recombination, and analysis of rise time and secondary peak obtained using gallium arsenides with different dopes are discussed. ESRO

N72-15696# Signals Research and Development Establishment, Christchurch (England).
THIN FILM THERMISTORS
B. J. Franklin and S. K. Archer Dec. 1970 60 p refs
(SRDE-70049) Avail: NTIS

Thin film thermistors have been deposited on glass substrate by sputtering mixed oxide ceramic materials. Devices have been produced with resistance in the range 1,000 ohms to several megohms with negative temperature coefficients of resistance from 1% to 5% per degree C dependent upon the resistivity of the film material. Chrome-gold contacts to the films have been found adequate so far in that the devices have low noise characteristics, and also adhere well to the substrates over the temperature range from - 100 to 150 C. Some important manufacturing variables have been isolated and are discussed, together with suggestions for improvements. Areas requiring more research and development work are indicated.
Author (ESRO)

N72-15697# Signals Research and Development Establishment, Christchurch (England).
SPUTTERED ZINC SULPHIDE FILMS ON SILICON
T. G. R. Rawlins Mar. 1971 14 p refs
(SRDE-71006) Avail: NTIS

The design of a triode RF sputtering system for the deposit of high purity films of zinc sulfide is outlined. It is shown that the deposited films have a high degree of purity and are highly oriented crystallographically. Author (ESRO)

N72-15698# Signals Research and Development Establishment, Christchurch (England).
THE ANNEALING OF ZnS FILMS ON SILICON
T. G. R. Rawlins and C. R. Jones Mar. 1971 14 p refs
(SRDE-71007) Avail: NTIS

ZnS films were annealed over periods of a few minutes during observations of their structure using electron diffraction. Annealing was also done over 24-hour periods in a separate furnace. It is shown that, for the range of thicknesses studied (0.1 to 1.2 micrometers), it is not possible to produce single crystal films, although it is possible to produce a definite improvement in structure. Work done on GaAs films is compared. Author (ESRO)

N72-15699# National Materials Advisory Board, Washington, D.C.
FUNDAMENTALS OF AMORPHOUS SEMICONDUCTORS Final Report
Sep. 1971 208 p refs
(Contract N00014-67-0244-0022)
(AD-731072; NMAB-284) Avail: NTIS CSCL 20/12

The study of glasses has been important historically because of their great technological usefulness. One class of these materials, amorphous semiconductors, has evoked a great deal of interest during the past few years. The report is intended to provide an overview of the field, its present standing, and its promise. The fundamental structural and electronic properties and the present level of understanding of these properties is of primary concern. However, much of the progress in solid state physics has traditionally been motivated by technological considerations. Therefore, the principal aspects of the physics underlying the more important amorphous semiconductor devices

are discussed, as well as the technological setting in which this new field finds itself. Author (GRA)

N72-15700# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
NEW METHODS FOR GROWTH AND CHARACTERIZATION OF GaAs AND MIXED III-V SEMICONDUCTOR CRYSTALS Final Technical Report, 1 Jul. 1970 - 30 Jun. 1971
William R. Wilcox 19 Aug. 1971 7 p refs
(Grant DAHC15-70-G-0014; ARPA Order 1628)
(AD-730018) Avail: NTIS CSCL 20/12

A new Czochralski technique for growing bulk gallium arsenide crystals has been invented and developed. A new technique for drying B2O3 for liquid encapsulation has been developed. It was discovered that surface moisture on vitreous B2O3 can be removed by exposing the material to a vacuum at room T. Improved smoothness of these films of GaAs grown by liquid epitaxy growth was achieved by adding arsenic to the hydrogen during growth. Alloy films have been grown and field effect transistors have been produced. Glow discharge spectroscopy was developed into an analytical technique for measuring and profiling the concentrations of constituents in these films. Theoretical advances have been made in the behavior of Schottky barriers. New polishing techniques, techniques for producing reliable ohmic contacts, and for orienting crystals have been developed. Author (GRA)

N72-15701# University Coll., Dublin (Ireland). Dept. of Chemistry.
ENERGY MIGRATION IN IRRADIATED SOLIDS Final Scientific Report, 1 Apr. 1967 - 30 Mar. 1971
Joseph Cunningham 30 Jun. 1971 48 p refs
(Contract F61052-67-C-0044; AF Proj. 9750-01)
(AD-730383; AFOSR-71-2402TR) Avail: NTIS CSCL 20/12

Evidence for energy migration over distances ca. 10 nm in semiconducting solids follows from results obtained on energy transfer at illuminated Gas/Semiconductor and Aqueous Solution/Semiconductor interfaces. Chemical changes at Gas/Semiconductor interfaces in the dark involved electron localization by adsorbed molecules as shown by studies of conductivity, electron spin resonance and kinetics. Additional chemical reaction was observed when these dark-equilibrated interfaces were exposed to UV light. For N2O(g)/ZnO(s), observed photoconductivity and kinetic results were consistent with migration of photo-produced holes to the interface followed by electrons but the quantum efficiency was only 0.00001. For CD3I(g)/ZnO(s), results were more consistent with migration of excitons. Author (GRA)

N72-15702# Battelle Memorial Inst., Columbus, Ohio.
ON THE MOTION OF THE A/2(111) SCREW DISLOCATION IN ALPHA IRON
P. C. Gehlen Oct. 1971 26 p refs
(Contract N00014-70-C-0390; NR Proj. 039-089)
(AD-731401; TR-12) Avail: NTIS CSCL 20/12

The atomic configuration of a microkink along a A/2 (111) screw dislocation in alpha-iron is described. The core in the kink is 2 to 3 Burgers vectors wide and 4 to 5 Burgers vectors long. The energy of the kink is 0.08 eV and the atomic positions in the core are not very sensitive to the size of the model and to the choice of interatomic force law. It is shown that infinitely long straight dislocations move only under Peierls stresses considerably larger than expected experimentally. Kinked dislocations on the other hand move under more reasonable stresses. Author (GRA)

N72-15703# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
FATIGUE CRACK PROPAGATION IN COPPER AND COPPER-ALUMINUM SINGLE CRYSTALS NO. 2
Hitoshi Ishii and Johannes Weertman 1 Sep. 1971 46 p refs
(Contracts N00014-67-A-0356-0016; Nonr-1228(32); Task-NR-031-725; ONR Proj. 5345-418)
(AD-731413; TR-10) Avail: NTIS CSCL 20/12

The effect of crystallographic orientation, temperature and stacking fault energy on the rate of fatigue crack propagation was studied in polycrystalline copper, copper single crystals and copper-aluminum single crystals at room temperature and at liquid nitrogen temperature. A stress intensity factor was used to normalize the crack propagation data. It was found that dislocation cross slip plays a critical role on the rate of fatigue crack propagation. Existing mathematical crack propagation formulae could not explain the data on single crystals. A new fatigue crack propagation model to explain the observed results is proposed. Author (GRA)

N72-15704# General Electric Co., Schenectady, N.Y. Research and Development Center.
EFFECTS OF HIGH PRESSURE ON MATERIALS: SYNTHESIS, STRUCTURE, AND PROPERTIES Final Report, 1 Jan. 1968 - 31 Jul. 1971
John S. Kasper and M. J. Moore Aug. 1971 14 p refs
(Contract F44620-68-C-0047; AF Proj. 9537)
(AD-730604; AFOSR-71-2530TR) Avail: NTIS CSCL 20/2

The broad objectives of the research discussed was twofold: To learn the nature of high-pressure phases and thereby to contribute to a better understanding of crystal chemistry and structural principles underlying the solid state; and to develop and assess the potentiality of the new linac method of obtaining neutron diffraction data. With regard to the first item, considerable progress has been made in characterizing a variety of materials and in developing improved techniques. Continual progress in technique has been made with the linac and various types of substances have been studied at elevated temperatures, as well as room temperature. Author (GRA)

N72-15705# Army Electronics Command, Fort Monmouth, N.J.
ELECTROMAGNETIC EFFECTS IN MAGNETIC INSULATORS
Maurice Weiner Jul. 1971 125 p refs
(DA Proj. 1H6-62705-A-055; Task-1H6-62705-A-055-05)
(AD-730637; ECOM-3460) Avail: NTIS CSCL 20/12

Electromagnetic waves are capable of strong coupling to two types of modes in magnetic insulators; low-frequency magnetostatic modes (or Walker modes), and high-frequency spinwaves (e.g., optical ferrimagnetic spinwaves). The coupling of electromagnetic waves with both types of magnetic modes has been investigated. The results obtained have been divided into two sections, according to the magnetic mode involved. The topics are magnetostatic electromagnetic interaction and high-frequency spinwave - electromagnetic interaction. GRA

N72-15706# Autonetics, Anaheim, Calif.
STUDY OF THE PREPARATION OF III-V ALLOY SEMICONDUCTORS WITH CONTROLLED BAND GAPS Final Report, 1 Apr. 1970 - 31 Mar. 1971
Harold M. Manasevit, William I. Simpson, and Ralph P. Ruth Apr. 1971 37 p refs
(Contract F19628-70-C-0178; Task-562009)
(AD-730624; C71-432/501; AFCRL-71-0299) Avail: NTIS CSCL 20/12

The feasibility of using a metalorganic-hydride process for the formation of epitaxial layers of Ga(1-x)InxAs alloy semiconductors on n-type GaAs and InAs single-crystal substrates has been investigated. Conditions have been established for the preparation of single-crystal layers with bandgap energies between 0.7 and 0.8 eV. The investigation has been based on a chemical vapor deposition process employing metalorganics such as trimethylgallium and triethylindium and gaseous hydrides such as arsine for growth of the alloys on the above substrates and on sapphire (Al2O3), the latter to facilitate evaluation of the alloy films. The feasibility of growth of alloys in a range of compositions has been clearly demonstrated. Carrier concentrations the order of 10 to the 16th power cu cm or below have been obtained, and room temperature mobilities as high as nearly 10,000 sq

cm/V-sec on (0001) Al2O3 and over 4000 sq cm/v-sec on (111) GaAs (A face) have been achieved. Experimentally determined optical bandgap energies and alloy compositions for the Ga1-xInxAs films indicate a smooth continuous variation of bandgap with the mole fraction of either cation. A bandgap energy of 0.7 eV results for a film containing 0.40 - 0.45 mole fraction of Ga. Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N72-15707*# Brunswick Corp., Lincoln, Nebr. Technical Products Div.
FILAMENT-WOUND, FIBERGLASS CRYOGENIC TANK SUPPORTS Final Report
J. S. Carter and T. E. Timberlake 15 Sep. 1971 73 p refs
(Contract NAS3-14627)
(NASA-CR-120828; BC-8367-FR) Avail: NTIS CSCL 13D

The design, fabrication, and testing of filament-wound, fiberglass cryogenic tank supports for a LH2 tank, a LF2/FLOX tank and a CH4 tank. These supports consist of filament-wound fiberglass tubes with titanium end fittings. These units were satisfactorily tested at cryogenic temperatures, thereby offering a design that can be reliably and economically produced in large or small quantities. The basic design concept is applicable to any situation where strong, lightweight axial load members are desired. Author

N72-15708# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.
STUDIES OF SLURRY FUELED PROPULSION SYSTEMS Semiannual Progress Report, 1 Feb. - 31 Jul. 1971
Cecil F. Warner, H. Lawrence Dyer, W. C. Mayse, and J. L. Ross Sep. 1971 44 p refs
(Contract N00014-67-A-0226-0013)
(AD-731078; TM-71-5; SAPR-3) Avail: NTIS CSCL 21/4

The literature pertinent to the combustion of single boron particles is reviewed in some detail. The objective of the review was to obtain information that may be employed to model the combustion of clouds of boron particles resulting from the spray of boron loaded slurry fuels. Descriptions are given of three combustor can configurations for use with an air atomizer slurry fuel injector. Author (GRA)

N72-15709# Army Missile Command, Redstone Arsenal, Ala. Propulsion Directorate.
DESIGN OF PROPELLANT FINS SUBJECTED TO AXIAL ACCELERATION
James H. Zike Aug. 1971 90 p refs
(DA Proj. 1M2-62303-A-214)
(AD-731208; RK-TR-71-15; AMCMS-Code-522C.11.214.00) Avail: NTIS CSCL 21/9

Large amounts of propellant burning surface area are required for very high acceleration missiles. Without sacrificing propellant weight, the use of large numbers of thin, solid propellant fins in recent test firings of the hypervelocity ACTION missile demonstrates a need for structural analysis to predict desirable fin configurations. A set of design charts is presented to aid in designing propellant fins for use in very high acceleration missiles. The charts show the maximum normal and maximum shear stresses encountered in propellant fin samples differing in length and web fraction when subjected to axial acceleration. Plane stress analysis and plots (PSAP), a computer program combining Rohm and Haas' data reduction computer program AMG067 and plane stress analysis program AMG072, is also presented. PSAP calculates stresses in a plane body and plots selected stress contours. GRA

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N72-15710 National Lending Library for Science and Technology, Boston Spa (England).
ON THE OIL LOSS PAST ENGINE CYLINDERS
Y. Wakuri Dec. 1971 36 p refs Transl. into ENGLISH from Junkatsu (Japan), v. 15, no. 8, 1970 p 455-468
(NLL-RTS-6560) Avail: Natl. Lending Library, Boston Spa, Engl.: £3.60; 12 NLL photocopy coupons

The processes by which oil losses occur from cylinders of internal combustion engines and methods for couteracting the losses are reviewed. The most important point was found to be the essential difference between the action of controlling the oil film and the action of oil scraping. The oil ring carries out the former function but has virtually no influence on the latter. The oil ring is almost entirely ineffective in relation to oil losses occurring from any cause other than the formation of hydrodynamic oil films and it is the compression ring's function in oil scraping which has prior significance. A large number of smaller engines are being designed on the basis of the effect of the compression rings on oil losses. It is important to preserve the initial form of the sliding face of the ring and there is increasing emphasis on improving the resistance to wear by such processes as chromium plating or molybdenum coating. Author

N72-15711*# Hughes Research Labs., Malibu, Calif.
THE 5 cm THRUST VECTORING SYSTEM Final Report
H. J. King Jun. 1971 97 p refs
(Contract NAS3-14058)
(NASA-CR-72877) Avail: NTIS CSCL 21H

Experimental data were taken with three different ion extraction systems, namely: (1) the dual grid electrostatic, (2) movable screen electrode, and (3) vectorable discharge chamber system, demonstrating that each is capable of vectoring the beam from a 5 cm thruster to plus or minus 10 degrees or more. The electrostatic system was chosen for a 100 hour endurance test over the latter two on the basis of speed of response and the absence of any moving parts. The performance of the electrostatic and movable screen systems is compared with that predicted on the basis of analytical models of each derived from a computer simulation of the ion trajectories of a single aperture. A table, comparing the merits of the various systems based on a wide range of criteria, is provided. Author

N72-15712*# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
SOOT OXIDATION RATES IN GAS TURBINE ENGINES
Samuel W. Radcliffe and John P. Appleton Jun. 1971 18 p refs
(Grant NGL-22-009-378)
(NASA-CR-125404; FML-Publ-71-12) Avail: NTIS CSCL 21E

A basis is proposed for extrapolating soot oxidation rate measurements obtained in laboratory flames to the more extreme operating conditions of gas turbine combustion chambers. The proposal is based on the observation that, within probable experimental uncertainty, the limited soot oxidation measurements correlate with the more extensive measurements of the surface oxidation rates of macroscopic samples of pyrographite. The soot oxidation rates thus determined for the conditions of a typical gas turbine combustion chamber are considerably lower than estimates which were based on simple extrapolations of the flame data. Author

N72-15713*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
DIMENSIONAL ANALYSIS CONSIDERATIONS IN THE ENGINE ROTOR FRAGMENT CONTAINMENT/DEFLECTION PROBLEM
John W. Leech, Emmett A. Witmer, and Raffi P. Yeghiayan Dec. 1971 24 p refs
(Grant NGR-22-009-339)
(NASA-CR-120841; ASRL-TR-154-3) Avail: NTIS CSCL 21E

Dimensional analysis techniques are described and applied to the containment/deflection problem of bursting high-rpm rotating parts of turbojet engines. The use of dimensional analysis to select a feasible set of experiments and to determine the important parameters to be varied is presented. The determination of a containment coefficient based on the nondimensionalized parameters is developed for the reduction of experimental data and as an assist to designers of containment/deflection devices. Author

N72-15714*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
***SWIRL CAN PRIMARY COMBUSTION** Patent Application*
Robert E. Jones and Richard W. Niedzwiecki Filed 27 Oct. 1971 10 p
(NASA-Case-LEW-11326-1; US-Patent-Appl-SN-192370) Avail: NTIS CSCL 21E

A swirl can, full-annulus combustor operable over a wide range of exit average temperatures is described for use in a high performance gas turbine engine for advanced aircraft. A large number of swirl can modules are mounted in an array in each combustor. NASA

N72-15715*# Israel Program for Scientific Translations, Ltd., Jerusalem.
INTERPLANETARY FLIGHT AND COMMUNICATION. VOLUME 2, NO. 5: THEORY OF ROCKET PROPULSION
N. A. Rynin 1971 66 p refs Transl. into ENGLISH of the publ. "Mezhplanetnye Soobshcheniya. Volume 2, no. 5: Teoriya Reaktivnogo Dvizheniya" Leningrad, 1929 Sponsored by NASA and NSF
(NASA-TT-F-644; TT-70-50115) Avail: NTIS CSCL 21H

A review of rocket flight studies, calculations, and predictions up to the year 1929 is presented. The earth's gravitational and atmospheric envelopes are considered, along with the physiological effects of acceleration, deceleration, and weightlessness. The reactive craft and propellant properties are described and equations of motion are given. The rocket thrust calculations and theories of Tsiolkovskii are discussed for flight inside and outside a gravitational field. The rocket flight studies of Esnault-Pelterie, Goddard, Oberth, Hohmann, and Valier are also reviewed. N.E.N.

N72-15716*# Curtiss-Wright Corp., Wood-Ridge, N.J.
INTEGRAL LIFT ENGINE PRELIMINARY DESIGN
W. Pratt, A. Leto, and R. Schaefer Nov. 1971 119 p refs
(Contract NAS3-14327)
(NASA-CR-120838; CW-WR-71-091F) Avail: NTIS CSCL 21E

A preliminary mechanical design of a complete lift fan engine system is reported. A description of the lift fan engine, layout drawings of the components and complete engine, and a discussion of the design analyses and results are presented. The design features and areas of analysis include fan and compressor rotor blades of composite construction, a combustor folded over the compressor, relatively high-temperature blades in the high-pressure turbine, the first stage of the low-pressure turbine used for bearing support and ducting of lubricant to the bearings, a complete lubrication system, critical speeds of the shafting, and vibration and flutter of the blading. Author

N72-15717*# United Aircraft Corp., East Hartford, Conn. Research Labs.
HANDBOOK FOR THE STUDY OF ELECTRIC PROPULSION SYSTEMS
R. V. Ragsac 22 Nov. 1968 145 p
(Contract NAS8-11309)
(NASA-CR-121086; G-110058-28) Avail: NTIS CSCL 21C

A compendium of techniques and basic information useful to the preliminary performance analysis of power-limited (low-acceleration, electric) propulsion systems applied to space missions is presented. The material is in handbook form and is reasonably complete within itself insofar as a basic understanding of the techniques and procedures is required for one to acquire facility in computing performance. This, in essence, is the objective of the handbook. The accumulation and organization of the material selected for inclusion was guided by the desire for simplicity and computational ease while maintaining a sufficient level of completeness for a general understanding. Author

N72-15718# Lockheed Missiles and Space Co., Palo Alto, Calif.
SPECIFIC IMPULSE OF CRYOGENIC-FUELED MICROENGINES
P. B. Semenikhin [1971] 4 p refs Transl. into ENGLISH from *Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), no. 3, 1971* p 50-53
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Mathematical models for single-component cold systems in which the cryogenic fuel is not burned up are discussed. It is shown that the usual expression for effective specific impulse is unrealistic, mostly because the total system mass and the quantitites govening it are not considered. An expression is developed which includes the masses of the tank insulation, heat exchanger, energy sources, and lost fuel. N.E.N.

N72-15719# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
GASDYNAMICS OF RESISTOJETS: INITIAL MODELLING AND PRELIMINARY RESULTS
I. Edwards and R. E. W. Jansson Aug. 1971 146 p refs
(AASU-304) Avail: NTIS

Theoretical predictions are presented of the performance of resistojets using ammonia and hydrogen as propellants. To set one bound for design studies a worst case model of the fluid flow is developed by numerical analysis. An investigation of the growth of the boundary layer in the resistojet nozzle, and its influence on performance was made. The approach adopted assumed that the nozzle flow had an inviscid core, which was treated as an isentropic, one-dimensional channel flow. Matrices of results for the stagnation conditions are presented and critically discussed. Author (ESRO)

N72-15720# Navy Space Systems Activity, Los Angeles, Calif.
AN EVALUATION OF ELECTRIC AND HYDRAZINE PROPULSION SYSTEMS FOR ORBIT MAINTENANCE Final Report
Richard V. Silverman May 1971 144 p refs
(AD-729294; NSSA-R40-70-3) Avail: NTIS CSCL 21/3

An evaluation of electric propulsion systems capable of providing thrust to counteract drag action on a certain satellite in a low earth orbit is presented. The orbit maintenance system is required to produce an average thrust of 1.6 fixed mass pounds over a mission duration of up to 2 years. Five candidate systems were studied: (1) a cesium bombardment ionization thruster, (2) a mercury bombardment ionization thruster, (3) a colloid thruster, (4) a hydrazine resistojet, and, as a standard of comparison, (5) a monopropellant hydrazine thruster, not electric. These propulsion devices were evaluated for two spacecraft configurations, one with a solar cell/battery power system, and the other with a reactor/thermoelectric power system. The preferred system for either spacecraft configuration is the monopropellant hydrazine system because of its low cost and because such a system is already included on the spacecraft for orbit insertion. Author

N72-15721# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AVIATION ENGINE VIBRATION THEORY AND CALCULATION
D. V. Khronin 25 Aug. 1971 533 p refs Transl. into ENGLISH of the book "Teoriya i Raschet Kolebanii v Dvigatelyakh Letatelnykh App." 1970 p 1-412
(AF Proj. 3066; Task-604010)
(AD-731351; FTD-HC-23-780-70) Avail: NTIS HC $6.00/MF $0.95 CSCL 21/5

The book deals with basic data on the general theory of vibrations of linear and nonlinear systems, their application to calculation of vibrations of parts, units and systems of aircraft engines. Given are contemporary methods for calculation of vibrations, which are developing in connection with the use of high speed computers; the method of initial parameters, the method of dynamic rigidities, the methods of discrete models and the integral method. The book represents a text book for students specializing in the strength of aircraft engines; it can be useful also to engineers of the aircraft industry. Author (GRA)

N72-15722# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UNSTABLE CONDITIONS OF TURBODYNAMICS: ROTATING STALL
V. N. Ershov 12 Aug. 1971 257 p refs Transl. into ENGLISH of the book "Neustoichivyye Rezhimy Turbomashin. Vrashchayushchiysya Sryv" Moscow, Izd-vo Mashinostroyeniye, 1966 p 1-180
(FTD Proj. 60401010A)
(AD-731355; FTD-MT-24-04-71) Avail: NTIS CSCL 21/5

The book gives the results of experimental and theoretical research of unstable conditions in turbodynamos. In this case primary attention is paid to conditions of rotating stall. The characteristics of the procedure of experimental research and of the low-inertia apparatus used in this case are described. Some methods of expansion of the area of stable conditions are given. This book is intended for scientific workers, graduate students, and engineer-designers working in the area of research and design of gas-turbine engines, compressors, fans, and pumps.
GRA

N72-15723# Rocket Research Corp., Redmond, Wash.
LONG LIFE MONOPROPELLANT HYDRAZINE ENGINE DEVELOPMENT PROGRAM Final Report, 6 Apr. 1970 - 25 Jun. 1971
Bruce W. Schmitz and Walter W. Wilson Sep. 1971 185 p refs
(Contract F04611-70-C-0036)
(AD-731287; RRC-71-R-257; AFRPL-TR-71-103) Avail: NTIS CSCL 21/8

The objective of the program was to demonstrate the capability of 1,000,000 pulses without performance loss on a flightweight monopropellant hydrazine 5-lbf thruster. This report describes the design, analysis, and tests which evolved into the final flightweight rocket engine assembly (REA) design during Phase I of the program. Phase IA testing of this REA accumulated 400,000 cycles of operation while delivering in excess of 80,000 lbf-sec with 20 ambient (40F) cold starts prior to performance degradation. Results of the testing are presented, together with recommendations for extending life capability on the basis of REA teardown and failure analysis. Concurrent testing of workhorse REA's to evaluate the relationship of propellant and catalyst temperatures upon catalyst life characteristics is also reported. Author (GRA)

N72-15724# Air Force Systems Command, Edwards AFB, Calif.
BIBLIOGRAPHY OF ADVANCED PROPULSION AND RELATED CONCEPTS, JANUARY 1970 - JANUARY 1971
Franklin B. Mead, Jr. Jul. 1971 28 p refs
(Proj. Outgrowth)
(AD-731290; AFRPL-TR-71-99) Avail: NTIS CSCL 21/3

The bibliography represents a compilation of technical documents surveyed during the calendar year of 1970. The documents cover various advanced propulsion concepts.
Author (GRA)

N72-15824 Defence Research Establishment Suffield, Ralston (Alberta).
TESTING THE RESPONSE OF GAS TURBINES TO AIR BLAST
J. C. Muirhead, R. Naylor, and C. G. Coffey *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 147-156 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation, and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N72-15725 California Univ., Los Angeles.
A DUST COMET IN THE SOLAR WIND Ph.D. Thesis
Emerson Fitzsimmons Stoops 1970 121 p
Avail: Univ. Microfilms Order No. 71-713

The interaction of a comet without significantly ionized atmosphere with the solar wind is studied by examining the equilibrium potential of dust grains as they traverse the head region of the comet. Considered is the ratio of forces produced by radiation pressure and aerodynamic drag on the dust grains. Results indicate that interaction of the dust comet with solar wind is expected even without the presence of a significantly ionized gas constituent to the conductivity of the comet's atmosphere. The interaction tends to sharpen the leading edge of the comet and produces the illusion that the comet's dust tail emanates from the head region in a direction other than along the sun-comet radius vector direction. Dissert. Abstr.

N72-15726*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UNUSUAL COSMIC RAY INTENSITY DECREASE OF 18 DECEMBER 1965
U. D. Desai and D. Venkatesan (Calgary Univ.) Dec. 1971 15 p refs Submitted for publication
(Grant NRC A-3865)
(NASA-TM-X-65797; X-663-71-507) Avail: NTIS CSCL 03B

A higher than normal ratio is reported for the decrease of cosmic ray intensity on 18 December 1965. This value was attributed to the depletion of a low rigidity electron component which also contributes to the counting rate of the IMP 3 detector. Significant difference is observed in the onset times recorded by the IMP 3 detector and Alert neutron monitor.
Author

N72-15727# Department of Supply, Melbourne (Australia). Antarctic Div.
COSMIC RAY RECORDS, MAWSON 1968 ANARE Data Reports Publication No. 111
A. Vrana and J. F. Reilly 1970 109 p refs
(NP-18962) Avail: AEC Depository Libraries

Tables are given of: (1) hourly data from the vertical telescope; (2) data from the wide-angle inclined-telescope for geomagnetic E and W azimuth headings; (3) data from the high-zenith angle telescope for geographic N and S azimuth headings; (4) uncorrected hourly data from the neutron monitor; (5) neutron monitor data corrected for barometric pressure variations; (6) hourly mean station level pressure; and (7) upper air data from all radiosonde flights conducted from the station.
NSA

N72-15728# Department of Supply, Melbourne (Australia).
STUDIES OF THE SIDEREAL DAILY VARIATION OF COSMIC RAY INTENSITY WITH PARTICULAR REFERENCE TO OBSERVATIONS AT 40 MWE UNDERGROUND
R. M. Jacklyn 1970 199 p refs
(NP-18960; ANARE-SR-Publ-114) Avail: AEC Depository Libraries

Continuous records over the years 1958-1965, from vertical telescopes at Hobart, provided the main source of information. Data from vertical telescopes at Budapest and from special experiments at Hobart with telescopes inclined 70 deg north, 30 deg north, and 45 deg south of zenith are also used. For comparison with the underground data, the available observations of an apparent sidereal daily variation at sea level were examined. Developments since 1965 are summarized and discussed. NSA

N72-15729# Imperial Coll. of Science and Technology, London (England).
THE DEPENDENCE OF RADIO PULSE AMPLITUDE ON FREQUENCY AND ON AIR SHOWER PARTICLE PARAMETERS
H. R. Allan, J. K. Jones (Leeds Univ.), N. Mandolesi (CNR, Bologna), J. H. Prah (Cape Coast Univ.), and P. Shutie 1971 7 p refs Presented at the 12th Intern. Conf. on Cosmic Rays, Hobart, Australia, 16 - 25 Aug. 1971 Sponsored in part by ESRO
Avail: NTIS

The radio pulse amplitude emitted by an air shower was measured for the frequencies 32, 60, and 105 MHz, with an antenna array. The observed field strengths per unit bandwidth were normalized to showers of standard primary energy and fixed angle with respect to geomagnetic field lines. The dependence of the normalized field strength frequency, shower zenith angle, distance from the shower axis, and the distribution of the shower particles with height, is discussed. ESRO

N72-15730# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
NORTHERN POLAR CAP PARTICLE FLUX VARIATIONS FOLLOWING THE 2 NOVEMBER 1969 EVENT
V. Domingo, D. E. Page, and M. L. Shaw 1971 18 p refs Presented at the Chestnut Hill Conf., Jun. 1971
Avail: NTIS

Particle intensity differences observed between ESRO 1A satellite at 1000 km and ESRO 1B at 300 km after the 2 November 1969 solar event are discussed. A notable feature was the apparent absence of auroral zone enhancements early in the event and the presence on the night side of the polar plateau of an intensity spike. The central plateau intensity rose in step with the interplanetary 45 keV electron intensity as measured by Explorer 35, suggesting direct connection of that region with interplanetary space. When ESRO 1A and 1B were on one occasion simultaneously over the northern polar cap, but in slightly different places, in-phase intensity variations were seen by both satellites. These would suggest that at that time a large area of the polar cap region was experiencing coherent temporal fluctuations at about one minute intervals. Author (ESRO)

N72-15731# Laboratoire d'Automatique et de Ses Applications Spatiales, Toulouse (France).
STUDY OF THE IONISER. TEMPERATURE CONTROL LOOP OF THE VAPORIZER [ETUDE DE L'IONISEUR. BOUCLE DE REGULATION DE LA TEMPERATURE DU VAPORISEUR]
C. Landrault Sep. 1971 36 p In FRENCH
(LAAS-NI-844) Avail: NTIS

Theoretical data on ionizers are reviewed (volt-ampere characteristics of perfect, theoretical, and experimental ionizers, etc.). The layout of the vaporizer temperature control loop is described. ESRO

N72-15732# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ABSOLUTE SPECTRAL MEASUREMENTS OF SOLAR RADIATION IN THE INFRARED REGION FROM 3-13 MICROMETER
I. Ya. Badinov, S. D. Andreev, and A. V. Poderovskii 29 Jun. 1971 23 p refs Transl. into ENGLISH from Probl. Fiz. Atm. (USSR), no. 3, 1965 p 189-202
(AD-729040; FTD-MT-24-47-71) Avail: NTIS CSCL 03/2

The following problems were set up: determination of absolute values for solar radiation flux within the earth's atmosphere at 3-13 micron; determination of the brightness temperature of the center of the solar disk in the given spectral range; and determination of the quantity of solar energy absorbed by the earth's atmosphere under different conditions in the examined spectral range. A cylindrical model of an absolute black radiator was used for energy calibration of the spectrophotometer. The radiator is described in detail. To study the solar spectrum, values for the relative solar radiation flux outside the atmosphere were obtained from observations of the spectrum transmissivity of the earth's atmosphere made in 1962 - 1963. Author (GRA)

N72-15733# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ON THE TEMPERATURE AND EMISSION MEASURE OF THERMAL RADIO BURSTS, JANUARY 1969 - DECEMBER 1970
Fred I. Shimabukuro 15 Aug. 1971 26 p refs
(Contract F04701-71-C-0172)
(AD-730599; TR-0172(2230-20)-1; SAMSO-TR-71-211) Avail: NTIS CSCL 03/2

Once the area of a thermal region has been determined, it is possible to obtain the temperature and emission measure of the burst by examination of the flux spectrum. Such determinations have been made for three events. Temperatures in the range 2 to 6 x 10 to the 6th power K and emission measures in the area of 2.6 to 5.4 x 10 to the 49th power/cc are consistent with radio observations. Electron densities are estimated to be of the order of 1 to 8 x 10 to the 10th power electrons cc. Author (GRA)

N72-15734# Air Force Cambridge Research Labs., Bedford, Mass. Ionospherics Physics Lab.
SUDDEN FREQUENCY DEVIATIONS, SOLAR EXTREME ULTRAVIOLET BURSTS, AND SOLAR RADIO BURSTS
David W. Richards 9 Jul. 1971 30 p refs
(AF Proj. 4643-01-01)
(AD-731167; AFCRL-71-0392; AFCRL-ERP-363;) Avail: NTIS CSCL 03/2

An investigation has been made of the interrelationship of solar extreme ultraviolet (EUV) bursts, solar radio bursts, and terrestrial ionospheric sudden frequency deviations (SFD's). No direct general relationships between radio spectra or burst intensities and SFD incidence or magnitude (Delta f) have been found. If the EUV enhancement is greater than 3 percent at Lambda 304 or Lambda 630 A, there is an 85 percent probability of occurrence of an SFD. Time of maxima of EUV and radio bursts are found to coincide extremely well. Author (GRA)

N72-15735*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTERPLANETARY SECTOR STRUCTURE AT SOLAR MAXIMUM
John M. Wilcox (Calif. Univ., Berkeley) and David S. Colburn 24 Jun. 1971 16 p refs Submitted for publication Prepared by Calif. Univ., Berkeley
(Grant NGL-05-003-230; Contract N00014-69-A-0200-1049; Grant NSF GA-16765; NR Proj. 021-109)
(NASA-TM-X-67601; AD-726704; SSL-Ser-12-Issue-51) Avail: NTIS CSCL 03/2

The interplanetary magnetic sector structure observed during 1969 is discussed. Two sectors per solar rotation, with occasional

smaller sectors were observed. Geomagnetic activity was found to increase after passage of a sector boundary. Author

N72-15736*# California Univ., Berkeley. Space Sciences Lab.
A ROTATING SOLAR MAGNETIC "DIPOLE" OBSERVED 1926 - 1968
John M. Wilcox and Walter Gonzalez 8 Jul. 1971 11 p refs Submitted for publication
(Grant NGL-05-003-230; Contract N00014-69-A-0200-1049; Grant NSF GA-16765)
(NASA-CR-125441; AD-727987; SSL-Ser-12-Issue-55) Avail: NTIS CSCL 03B

A recurring pattern with a period of 26 7/8 days observed in the polar geomagnetic field during 1926 to 1941 appears to persist in the interplanetary magnetic field polarity observed with spacecraft during 1963 to 1968. This suggests the existence of a rotating solar magnetic dipole with a period of 26 7/8 days plus or minus 0.003 days. Author (GRA)

N72-15345# European Space Research Inst., Frascati (Italy).
ON THE STRUCTURE OF THE GEOMAGNETIC TAIL
Karl Schindler *In* ESRO Wave-Particle Interactions in the Magnetosphere Aug. 1971 p 81-82 refs (See N72-15339 06-13)
Avail: NTIS

N72-15763# Cambridge Univ. (England). Dept. of Applied Mathematics.
SPACE RESEARCH AND OBSERVATIONAL COSMOLOGY
D. W. Sciama *In* ESRO The Significance of Space Res. for Fundamental Phys. May 1971 p 5-8 refs (See N72-15762 06-30)
Avail: NTIS

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N72-15737 Rochester Univ., N.Y.
ASTRONOMICAL PROPERTIES OF M-SUPERGIANTS Ph.D. Thesis
Anthony S. Wawrukiewicz 1970 115 p
Avail: Univ. Microfilms Order No. 71-1433

M-supergiants have been studied in detail in an effort to determine their usefulness in discussing galactic structure. Wide-band photometry and rederived quantities were applied to a large number of M-supergiants, including many stars of the Warner and Swasey surveys, to obtain distances. The resultant pattern in the galaxy evidenced by these stars strongly suggests that M-supergiants are useful as age indicators. Finally, a discussion was made of the bright red content of nearby galaxies. It was concluded that M-supergiants almost certainly exist in other galaxies. Thus accurate distances can be determined to these galaxies which are independent of the Cepheid stars.
Dissert. Abstr.

N72-15738 Indiana Univ., Indianapolis.
COOL STAR SPECTRUM SYNTHESIS Ph.D. Thesis
Bernard Vernon Jackson 1970 143 p
Avail: Univ. Microfilms Order No. 70-26930

By reproducing the spectrum of a cool star, the problems of spectrum line blends and the lack of a well-defined continuum can be overcome. A theoretical profile was produced using the semi-empirical Minnaert formula. Individual wavelength dependent line absorption coefficients were produced from the Harris function, and the profile was computed and was then smeared by a Gaussian function to approximate line broadening. This procedure was tested on the solar spectrum obtained from the Utrecht Solar Atlas and gives results consistent with known solar abundances, temperature, and electron density. It was also used to duplicate a spectrum from a 3300 K effective temperature model, reproducing the model spectrum exactly. The method was also applied to the stars alpha Herculis and 54 Eridani to duplicate observed portions of the stellar spectrograms.
Dissert. Abstr.

N72-15739*# Aerospace Corp., El Segundo, Calif. Systems Planning Div.
INTEGRATED OPERATIONS/PAYLOADS/FLEET ANALYSIS. VOLUME 5: MISSION, CAPTURE AND OPERATIONS ANALYSIS Final Report
Aug. 1971 178 p refs
(Contract NASw-2129)
(NASA-CR-124722; ATR-72(7231)-1-Vol-5) Avail: NTIS CSCL 22A

The current baseline mission model consists of the DOD Option B prepared for space transportation system mission analysis and a NASA model prepared for the integrated operations /payloads/ fleet analysis. Changes from the previous mission model are discussed, and additional benefits of the reusable space shuttle system are identified. The methodology and assumptions used in the capture analysis are described, and satellite and launch vehicle traffic models for the current and low cost expendable launch vehicle systems and the reusable space shuttle system are presented. The areas of fleet sizing, limitations and abort modes, system ground support requirements, and ground support systems assessment are covered. Current and extended launch azimuth limitations used for both ETR and WTR are presented for the current and low cost expendable vehicles and also the reusable space shuttle system. The results of a survey of launch support capability for the launch vehicle fleets are reported. Author

N72-15740# Thessaloniki Univ. (Greece).
COMPUTATION OF THE ORBITS OF THE ARTIFICIAL EARTH SATELLITES, VOLUME 1 Ph.D. Thesis
Emmanouel Tsimis 1969 216 p In GREEK
Avail: NTIS

The satellite orbits are calculated and studied to justify the establishment of a tracking station at the University of Thessaloniki for utilizing orbital data in geodesy. The theory of the two body problem is developed, and analytical methods of orbit calculation are presented on the basis of the two body problem and those factors affecting it. The most important factors influencing the orbit computations are studied in detail. These factors are identified as anomalies in the earth's gravity field, the terrestrial atmosphere, solar and lunar attraction, solar radiation, and precession and nutation. Satellite ephemerides and bulletins published in the United States are discussed. Author

N72-15741# Thessaloniki Univ. (Greece).
COMPUTATION OF THE ORBITS OF THE ARTIFICIAL EARTH SATELLITES, VOLUME 2 Ph.D. Thesis
Emmanouel Tsimis 1969 209 p refs In GREEK
Avail: NTIS
For abstract, see N72-15740.

N72-15742*# Wyoming Univ., Laramie. Natural Resources Research Inst.
ORBITAL OPERATIONS STUDIES Final Report
John C. Bellamy Jun. 1971 5 p refs
(Grant NGR-51-001-001)
(NASA-CR-122320) Avail: NTIS CSCL 22C

Nautical units being developed for coordinating the space-time positions of things throughout the earth's atmosphere and the earth-centered region of space are considered. Three aspects of the problem are briefly summarized. K.P.D.

N72-15743*# Hulburt (E. O.) Center for Space Research, Washington, D. C.
[SPACE ASTRONOMY AND UPPER ATMOSPHERIC SOUNDING] Annual Report, 1969
Herbert Friedman 1 Jul. 1971 78 p refs
(NASA-Order W-13085)
(NASA-CR-125398) Avail: NTIS CSCL 03A

The discoveries and activities of the Space Science Program are reported. Results of studies are presented for the following areas: gamma and x-ray astronomy, optical geophysics and solar wind, infrared astronomy, radio astronomy, and rocket spectroscopy. Lists of publications, talks, and conferences are included. F.O.S.

N72-15744*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Space Station Program
INTEGRATED MISSION MANAGEMENT OPERATIONS
Nov. 1971 561 p
(Contract NAS8-25140)
(NASA-CR-121076; MDC-G2600) Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

Operations required to launch a modular space station and to provides sustaining ground operations for support of that orbiting station throughout its 10 year mission are studied. A baseline, incrementally manned program and attendent experiment program options are derived. In addition, features of the program that significantly effect initial development and early operating costs are identified, and their impact on the program is assessed. A preliminary design of the approved modular space station configuration is formulated. Author

N72-15745*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DESCRIPTION OF CORE SAMPLES RETURNED BY APOLLO 12
John F. Lindsay and Roald Fryxell (Wash. State Univ.) Nov. 1971 26 p refs
(NASA-TM-X-58066) Avail: NTIS CSCL 03B

Three core samples were collected by the Apollo 12 astronauts. Two are single cores, one of which (sample 12026) was collected close to the lunar module during the first extravehicular activity period and is 19.3 centimeters long. The second core (sample 12027) was collected at Sharp Crater during the second extravehicular activity period and is 17.4 centimeters long. The third sample is a double core (samples 12025 and 12028), which was collected near Halo Crater during the second extravehicular activity period. Unlike the other cores, the double-drive-tube core sample has complex layering with at least 10 clearly defined stratigraphic units. This core sample is approximately 41 centimeters long. Author

N72-15746*# National Aeronautics and Space Administration, Washington, D.C.
HEOS-A2: PRESS KIT
Howard Allaway and James Kukowski [Jan. 1972] 14 p
(NASA-News-Release-72-17) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22A

The characteristics of the HEOS-A2 satellite and its assigned mission are discussed. The spacecraft carries seven experiments to investigate the strength and direction of the magnetic fields encountered, the energy distribution of protons and electrons, the nature of the solar winds, detection of micrometeorites, and low frequency solar observations. The highly elliptical polar orbit required for this mission will have an apogee of 38 earth radii. The lifetime of the satellite is expected to be one year minimum. Author

N72-15747*# Scientific Translation Service, Santa Barbara, Calif.
DETERMINATION OF THE OPTIMUM COMPOSITION AND PROGRAM OF TRAJECTORY MEASUREMENTS
N. N. Kozlov Washington NASA Jan. 1972 64 p refs Transl. into ENGLISH from Opredeleniye Optimalnogo Sostava i Programmy Trayektornykh Izmereniy, Inst. of Applied Math., USSR Acad. of Sci., Moscow, 1970
(Contract NASw-2035)
(NASA-TT-F-695) Avail: NTIS CSCL 22A

The problem of selecting the effective composition and program of trajectory measurements, whose errors are random and independent, is discussed. the concept of the density of measurements of a homogeneous composition (control) is introduced, and the corresponding variational problems are formulated. A proof is presented for the theorem of a nonsingular solution in these problems, when there are limitations on the density and the total number of measurements. Singular solutions are studied. An algorithm is presented for finding the non-singular solution, making it possible to obtain the optimum compositions and measurement programs for specific problems. A solution is presented to the problem of optimal distribution of radial velocity measurements when determining the orbit of an artificial satellite of Mars. Author

N72-15748*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Space Station Task Team.
SPACE STATION MSFC-DPD-235/DR NO. CM-03 SPECIFICATION, MODULAR SPACE STATION PROJECT, PART 1 CEI
Dec. 1971 379 p
(Contract NAS8-25140)
(NASA-CR-121080; MDC-G2577-Pt-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Contract engineering item specifications for the modular space station are presented. These specifications resulted from the development and allocations of requirements which are concise statements of performance or constraints on performance. Specifications contain requirements for functional performance and for the verification of design solutions. Author

N72-15749# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS
William M. Leak, (ed.) Dec. 1971 42 p refs
(NAVSO-P-3012) Avail: NTIS

Research at the NRL is reported. Subjects discussed include: laser generated fusion plasmas; high frequency accelerator comparator; controllability, realization, and stability of discrete-time systems; metallurgy; microstructure and magnetic behavior of superconducting V3Ga; ocean technology; and fluid models for Tokamak plasmas. Papers presented at scientific meetings, and patents issued during October and November 1971 on inventions by employees of the Laboratory are listed. F.O.S.

N72-15750*# Israel Program for Scientific Translations, Ltd., Jerusalem.
INTERPLANETARY FLIGHT AND COMMUNICATION. VOLUME 1, NO. 2: SPACECRAFT IN SCIENCE FICTION
N. A. Rynin 1971 183 p refs Transl. into ENGLISH of the publ. "Mezhplanetnye Soobshcheniya. Volume 1, no 2: Kosmicheskie Korabli" Leningrad, 1928 Sponsored by NASA and NSF
(NASA-TT-F-641; TT-70-50112) Avail: NTIS CSCL 22A

A series of technical projects on space flight as proposed by writers in fictional novels is presented. Descriptions are given of the landscapes and portrayals of inhabitants of other worlds, as these are presented by various authors. Such illustrations are based on the inventions of the author's imagination or on reasoning concerning the possible forms of landscapes and living beings originating in physical and chemical conditions of different celestrial bodies about which information is provided by modern astronomy, astrophysics, and astrochemistry. Author

N72-15751*# Wisconsin Univ., Madison. Space Science and Engineering Center.
[THE POINTING ERRORS OF GEOSYNCHRONOUS

SATELLITES] Progress Report, 1 Aug. - 31 Oct. 1971
Dhirendra N. Sikdar and Aniruddha Das 31 Oct. 1971 54 p refs
(Contract NAS5-11542)
Avail: NTIS CSCL 22C

A study of the correlation between cloud motion and wind field was initiated. Cloud heights and displacements were being obtained from a ceilometer and movie pictures, while winds were measured from pilot balloon observations on a near-simultaneous basis. Cloud motion vectors were obtained from time-lapse cloud pictures, using the WINDCO program, for 27, 28 July, 1969, in the Atlantic. The relationship between observed features of cloud clusters and the ambient wind field derived from cloud trajectories on a wide range of space and time scales is discussed. Author

N72-15752# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE NO. 268
14 Jan. 1972 66 p refs Transl. into ENGLISH from various Soviet-bloc publications
(JPRS-54940) Avail: NTIS

Materials from recent publications of the Sino-Soviet bloc countries are presented in the form of abstracts, summaries, and occasionally full articles. The topics covered are astronomy, meteorology, oceanography, geology, upper atmosphere, and space research. Author

N72-15753*# Lehigh Univ., Bethlehem, Pa.
METALLOGRAPHIC AND ELECTRON-MICROPROBE STUDIES OF RETURNED LUNAR SAMPLES WITH SIGNIFICANT AMOUNTS OF METALLIC Fe-Ni Final Technical Progress Report
J. I. Goldstein 29 Nov. 1971 9 p refs
(Contract NAS9-10401)
(NASA-CR-115312) Avail: NTIS CSCL 03B

Metal particles from the Apollo 11 and 12 soil are both meteoritic and lunar in origin. In the Apollo 12 soil, most of the metal particles are meteoritic, based on their Ni-Co contents. On the other hand, there is a much smaller proportion of meteoritic metal among the metallic inclusions in the lunar soil particles. The structures and compositions of the phases present in many of the remelted metal particles indicate either slow cooling or a reheating of those samples on the moon's surface in the 500-600 C temperature range for a year or more. Most of the meteoritic particles studied were probably originally pieces of chondrites. Author

N72-15754*# Massachusetts Inst. of Tech., Cambridge.
[HIGH ENERGY ASTRONOMY OR ASTROPHYSICS AND PROPERTIES OF THE INTERPLANETARY PLASMA] Annual Progress Report
Dec. 1971 59 p refs
(Grant NGL-22-009-015)
(NASA-CR-125400; CSR-PR-1462-2) Avail: NTIS CSCL 03A

The research activities related to high energy astrophysics and interplanetary plasma are reported. The experimental work in the following areas are described: (1) balloon-and rocket-borne cosmic X-ray, (2) X-ray spectroscopy, and (3) OSO-3 gamma ray experiment. Plasma studies in the interplanetary region, magnetosphere, and geomagnetic tail are included. F.O.S.

N72-15755# Lund Observatory (Sweden).
A STUDY OF INTERSTELLAR REDDENING IN A REGION IN OPHIUCHUS
Carl Schalen 1972 56 p refs
(Rept-3) Avail: NTIS

The results of an investigation based on photometric and spectral plates are presented. The two-color diagram of the whole region is given. It seems probable that the reddening law is normal although the two-color diagram does not exclude the possibility that the reddening line is somewhat steeper than normal. No part of the region is free from interstellar extinction. The relations between color excess and distance modulus were derived for two areas with different amounts of reddening. The total reddening amounts to 0m.30 in the less absorbed area and to about twice that amount in the darker area. The reddening sets in at a distance modulus approximately 7.0 in both areas. The distribution of the absorbing matter is discussed. A study of the number of stars of different magnitudes shows that all A0 stars are situated behind the reddening material but the late type giant stars and the F stars are only slightly affected by the absorbing material. An extinction curve was derived, though only in the narrow wavelength interval from V to U. It approximately agrees with Nandy's curve for the Cygnus region. Author

N72-15756*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE ALTITUDE DETERMINATION UNCERTAINTIES
Joseph W. Siry Sep. 1971 41 p refs Presented at the Sea Surface Topography Conf., Key Biscayne, Fla., 6-8 Oct. 1971
(NASA-TM-X-65796; X-550-71-505) Avail: NTIS CSCL 22C

Satellite altitude determination uncertainties are discussed from the standpoint of the GEOS-C satellite. GEOS-C will be tracked by a number of the conventional satellite tracking systems, as well as by two advanced systems; a satellite-to-satellite tracking system and lasers capable of decimeter accuracies which are being developed in connection with the Goddard Earth and Ocean Dynamics Applications program. The discussion is organized in terms of a specific type of GEOS-C orbit which would satisfy a number of scientific objectives including the study of the gravitational field by means of both the altimeter and the satellite-to-satellite tracking system, studies of tides, and the Gulf Stream meanders. Author

N72-15757*# Mathematica, Inc., Princeton, N.J.
ECONOMIC ANALYSIS OF NEW SPACE TRANSPORTATION SYSTEMS, VOLUME 2
[1971] 432 p refs 2 Vol.
(Contract NASw-2081)
(NASA-CR-125406) Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

Projected space missions and transportation systems for 1978 to 1990, including payloads and costs, are discussed. The space activites are described in terms of missions and traffic schedules provided by NASA and DoD and by study contractors. Details are given on expendable launch vehicles, fully reusable and hybrid space shuttle concepts, shuttle operations, space tugs, and other system concepts. Launch vehicle and payload costs are measured and classified for three different space transportation systems, and the data are considered with respect to primary and secondary sources, and sources of uncertainty in the development program. Quantitative results for Scenarios 2 and 4 through 15 are included. For Vol. 1, see N72-13929; for executive Summary, see N72-13928. N.E.N.

N72-15758*# Lowell Observatory, Flagstaff, Ariz.
THE DEVELOPING STAGES OF THE MARTIAN YELLOW STORM OF 1971
Charles F. Capen and Leonard J. Martin 30 Nov. 1971 6 p
(Grant NGR-03-003-007)
(NASA-CR-125415; Bull-157-Vol-7-No-20) Avail: NTIS CSCL 03B

A history of the yellow storm on Mars which occurred in 1971 is presented. It is compared to the Great 1956 Yellow Cloud, and possible yellow storms are predicted for 1973. Photographs of the stages of evolution and the path of the storm are included. K.P.D.

N72-15759*# Geological Survey, Washington, D.C.
LUNAR TERRAIN MAPPING AND RELATIVE-ROUGHNESS ANALYSIS
Lawrence C. Rowan, John F. McCauley, and Esther A. Holm

1971 36 p refs
(NASA Order W-11775)
(NASA-CR-125424; Paper-599-G; LC-74-609839) Avail: NTIS; SOD $0.45 CSCL 03B

Terrain maps of the equatorial zone were prepared at scales of 1:2,000,000 and 1:1,000,000 to classify lunar terrain with respect to roughness and to provide a basis for selecting sites for Surveyor and Apollo landings, as well as for Ranger and Lunar Orbiter photographs. Lunar terrain was described by qualitative and quantitative methods and divided into four fundamental classes: maria, terrae, craters, and linear features. Some 35 subdivisions were defined and mapped throughout the equatorial zone, and, in addition, most of the map units were illustrated by photographs. The terrain types were analyzed quantitatively to characterize and order their relative roughness characteristics. For some morphologically homogeneous mare areas, relative roughness can be extrapolated to the large scales from measurements at small scales. Author

N72-15760*# California Univ., Los Angeles.
REDUCTION AND ANALYSIS OF MAGNETOMETER DATA FROM MARINERS 4 AND 5 Final Report
8 Dec. 1971 8 p
(Grant NGR-05-007-064)
(NASA-CR-125420) Avail: NTIS CSCL 03B

In studies of data from the Mariner 4 and Mariner 5 magnetometers evidence has been found that during the flights, negative (toward the sun) polarity dominated at latitudes above the solar equatorial plane and positive polarity dominated at latitudes below this plane. A subsequent check of data taken with other spacecraft during 1964 through 1967 provided additional evidence of this effect. It is suggested that the dominant polarity of the interplanetary magnetic field follows the hemisphere-dependent dipolar field of the sun. Thus, the photospheric dipolar field may be an important source of the interplanetary magnetic field, especially at quiet times. It has also been found that, for an interplanetary magnetic field of a given polarity, the north-south component has a nonzero mean value in regions above and below the solar equatorial plane. Author

N72-15761# Joint Publications Research Service, Washington, D.C.
IONIZING RADIATION IN SPACE AND SPACE FLIGHTS
Yu. G. Grigoryev, V. I. Yefimov, V. M. Petrov, and Ye. Ye. Kovalev 20 Jan. 1972 8 p refs Transl. into ENGLISH from Gigiyena i Sanitariya (Moscow), no. 10, 1971 p 45-49
(JPRS-54992; UDC-613.648.613.693) Avail: NTIS

Both continuous and sporadic sources of radiation in space are considered. These include continuous cosmic radiation, continuous emissions of the terrestrial radiation belts, and solar explosions. Radiation danger to spacecraft crews is discussed, and methods of protection are suggested. Permissible radiation danger to crews are proposed. K.P.D.

N72-15762# European Space Research Organization, Paris (France).
THE SIGNIFICANCE OF SPACE RESEARCH FOR FUNDAMENTAL PHYSICS
A.F. Moore and V. Hardy, eds. May 1971 178 p Proc. of an ESRO colloq. held at Interlaken, Switzerland, 4 Sep. 1969
(ESRO-SP-52) Avail: NTIS

Applications of relativity theory to problems of astronomy and cosmology are discussed, and tests for observable relativistic effects are reviewed. For individual titles, see N72-15763 through N72-15769.

N72-15763# Cambridge Univ. (England). Dept. of Applied Mathematics.
SPACE RESEARCH AND OBSERVATIONAL COSMOLOGY
c29
D. W. Sciama *In* ESRO The Significance of Space Res. for Fundamental Phys. May 1971 p 5-8 refs (See N72-15762 06-30)
Avail: NTIS

Systematic artificial satellite observations of quasars and of the possibly extragalactic background radiation at a variety of frequencies are now required in order to make further progress in these subjects. Intergalactic absorption effects might be detected by making ultraviolet observations of the continuous spectra of galaxies and quasars. The redshift of the intergalactic gas would produce an absorption trough. The resonance scattering by helium should also be measured, as the helium/hydrogen ratio in the intergalactic medium would help to settle several problems. The O VI resonance transition at 1031 A in intergalactic space should also be investigated. Author (ESRO)

N72-15764# Centre National de la Recherche Scientifique, Verrieres-Le-Buisson (France).
THE EXPERIMENTAL DETERMINATION OF THE SPACE-TIME METRIC
J. Blamont *In* ESRO The Significance of Space Res. for Fundamental Phys. May 1971 p 9-15 refs (See N72-15762 06-30)
Avail: NTIS

The use of the quadruple moment of the sun and general relativity tests to determine values of the space-time measures beta and gamma are discussed. The tracking of a drag-free system onboard a spacecraft in an eccentric heliocentric orbit, and measurement of the transit time of an electromagnetic signal between the earth and the spacecraft near superior conjection are proposed for new measurements of beta, gamma and J2, a measure of the quadrupole moment. Author (ESRO)

N72-15765# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
SOLAR-SYSTEM TESTS OF GRAVITATIONAL THEORIES
I. I. Shapiro *In* ESRO The significance of Space Res. for Fundamental Phys. May 1971 p 17-21 refs (See N72-15762 06-30)
Avail: NTIS

The progress in ground-based tests of general relativity, and problems and prospects for corresponding space flight experiments, are discussed. Current solar system gravitational tests are based on radar delay time measurements. An increase in echo time attributable to solar gravity has been detected using this earth-based method, but an accuracy of no better than 5% was obtained. The solar corona plays an important role in increasing accuracy. The use of a spacecraft for gravitational tests with radar delay measurements is suggested, and solutions to the inherent problem of uncertainties in solar radiation pressure and gas leakage perturbation measurements are discussed. ESRO

N72-15766# Cambridge Univ. (England). Inst. of Theoretical Astronomy.
THE COSMOLOGICAL SIGNIFICANCE OF OBSERVATIONS AT FAR-INFRARED AND MILLIMETRE WAVELENGTHS
M. J. Rees *In* ESRO The Significance of Space Res. for Fundamental Phys. May 1971 p 23-28 refs (See N72-15762 06-30)
Avail: NTIS

Observations of the background spectrum around 1 mm wavelength should provide a crucial test of hot big bang theories and may yield additional information on the early history of the expanding universe. Apart from their fundamental importance for cosmology, observations from above the atmosphere in the 100 micron to 1 mm band will be of great relevance to astronomical studies of molecules and interstellar dust. ESRO

N72-15767# Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
THE EXPANSION OF THE GALAXY
G. B. Field, M. J. Rees, and D. W. Sciama *In* ESRO The Significance of Space Res. for Fundamental Phys. May 1971

p 29-32 refs (See N72-15762 06-30)
Avail: NTIS

Gravitational wave experiments are briefly reviewed, and a discussion is presented of whether radiation analysis is much improved by using sidereal time and whether all the radiation could come from a single direction. Studies of the rotation curve of the galaxy are also discussed, and it is suggested that there is a mass loss of 70 solar masses per year in the galaxy, averaged over the last 10 to the 8th power years, due to gravitational radiation arising from catastrophic phenomena not yet understood. Author (ESRO)

N72-15768# Stanford Univ., Calif. Dept. of Physics.
THEORETICAL BACKGROUND AND PRESENT STATUS OF THE STANFORD RELATIVITY-GYROSCOPE EXPERIMENT
C. W. F. Everitt, W. M. Fairbank, and L. I. Schiff *In* ESRO The Significance of Space Res. for Fundamental Phys. p 33-43 refs (See N72-15762 06-30)
Avail: NTIS

A proposal that a measurement of the precession of the spin axis of a gyroscope moving through the earth's gravitational field would provide a test of Einstein's general theory of relativity is discussed in terms of the Brans-Dicke theory and other recent developments. It is shown that an accuracy of 0.001 arc second per year in the orientations of two or more gyroscopes is required. This would also provide a rough measure of the quadrupole effect. Applicable large scale low temperature techniques and advanced techniques in electronic instrumentation and control theory, are discussed in detail. Parts of the laboratory prototype are being tested and it is hoped that a preliminary test flight will take place in 1973 or soon afterwards. Author (ESRO)

N72-15769# Institute for Advanced Study, Princeton, N.J.
RELATIVISTIC COSMOLOGY AND SPACE PLATFORMS
Remo Ruffini and John Archibald Wheeler (Princeton Univ., N. J.) *In* ESRO The Significance of Space Res. for Fundamental Phys. May 1971 p 45-174 refs Sponsored jointly by ESRO and NASA (See N72-15762 06-30)
(NASA-CR-125418) Avail: NTIS CSCL 03B

Einstein's 1915 theory of general ralativity, or geometrodynamics, introduced geometry as a dynamic factor in the field of physics. The role of curved space geometry, both static and dynamic, lends itself to investigations from space platforms or from the ground. Among those discussed here are: (1) properties of a superdense or neutron star, (2) pulsar physics, (3) collapse of a star with a large dense core into a superdense star during a supernova event, or complete collapse to a black hole; (4) black hole physics; (5) galactic centers, jets, and quasi-stellar sources; (6) gravitational radiation; (7) models of the universe; (8) promordial fireball radiation; (9) the time scale of universe expansion; (10) the universe as a lens for magnifying the apparent diameter of a far away galaxy; (11) galactic formation; and (12) the solar system as a testing ground for the theory of relativity. This last problem includes three tests for relativity, i.e., the retardation of light as it passes close to the Sun on its way to Venus and back, relativistic effects in planetary motion, and searching via corner reflectors on the Moon for relativistic effects in the Moon's motion. Author (ESRO)

N72-15770# European Organization for Nuclear Research, Geneva (Switzerland). Div. d'Etudes Theoriques.
NEUTRAL AND IONIZED HYDROGEN AND ANTIHYDROGEN ANNIHILATION REACTIONS: ASTROPHYSICAL APPLICATIONS [REACTIONS D'ANNIHILATION DE L'HYDROGENE ET L'ANTIHYDROGENE NEUTRES ET IONISES: APPLICATIONS ASTROPHYSIQUES]
J. L. Puget 17 Aug. 1970 58 p refs In FRENCH Sponsored by ESRO
Avail: NTIS

Matter-antimatter annihilation reactions, playing an important role in astrophysical models, are reviewed. The astrophysical consequences of OMNES theory on matter-antimatter separation in a black body at very high temperature were studied. An attempt was also made to determine the hydrogen-antihydrogen annihilation ratio in a wide range of physical conditions by extrapolating proton-antiproton annihilation cross sections towards very low energies, and by computing hydrogen-antihydrogen and proton-antihydrogen annihilation cross sections. These results were used to compare metagalactic X and gamma spectra measurement with the theory. ESRO

N72-15771# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
SUPRATHERMAL IONS NEAR THE MOON
J. W. Freeman (Rice Univ.), M. A. Fenner (Rice Univ.), H. K. Hills (Rice Univ.), R. A. Lindeman (Rice Univ.), R. Medrano, and J. Meister 1971 27 p refs Presented at the 15th IUGG Gen. Assembly, Moscow, Aug. 1971 Submitted for publication
(Contract NAS9-5911)
(TRITA-EPP-71-24) Avail: NTIS

Some preliminary results from the Suprathermal ion detectors deployed on the lunar surface by the Apollo 12 and 14 Astronauts. Salient features of these results include: the possible observation of sporadic venting of gas from the lunar surface; evidence for a prompt ionization and acceleration mechanism operating in the lunar exosphere; and a preliminary measurement yielding approximately 1 month for the e-folding decay time for the heavier components of the exhaust gases from the Apollo lunar landing systems. Prominent phenomena from which these results have been derived are described. Author (ESRO)

N72-15772# Army Missile Command, Redstone Arsenal, Ala.
CALCULATION OF AZIMUTH ANGLES BETWEEN TWO GEOGRAPHIC POINTS
James C. Harrington Jun. 1971 9 p
(Proj. SAM-D)
(AD-730899) Avail: NTIS CSCL 16/2

In air defense studies it is often necessary to know the azimuth angle of one geographic point measured with respect to a second geographic point. This report contains mathematics and procedures for calculating the azimuth angles when the two geographic points are on any specified spheroid. Author (GRA)

N72-15773# Naval Ordnance Lab., White Oak, Md.
BIBLIOGRAPHY OF NOL TECHNICAL DOCUMENTATION IN AEROBALLISTICS AND HYDROBALLISTICS Technical Report, 1 Jan. 1969 - 31 Dec. 1970
18 Aug. 1971 33 p refs
(AD-731030) Avail: NTIS CSCL 19/4

Contents: Hypersonic characteristics; Wind tunnels; Turbulence; Subsonic characteristics; Transonic characteristics; Supersonic characteristics; Boundary layer; Superaerodynamics; Ballistics. GRA

N72-15774# Florida Univ., Gainesville. Dept. of Physics and Astronomy.
RADIO ASTRONOMY OF THE PLANETS Final Report
Alex G. Smith Sep. 1971 35 p refs
(Contract N00014-68-A-0173-0005)
(AD-730090) Avail: NTIS CSCL 03/1

The University of Florida Radio Observatory has concentrated on the study of low-frequency sporadic emissions from the planets. Major emphasis has been placed on Jupiter, with the objective of maintaining a long-term, consistent record of the intensity, polarization, and temporal structure of the decametric radiation from that planet over as wide a frequency range as is practicable at any given phase of the solar cycle. A continuous program of reduction, machine analysis, and interpretation of the data is maintained for the purpose of determining the characteristics of the radiation, its correlation with known properties of the planet and its satellites, as well as possible correlations with solar and geophysical parameters. Theoretical studies are made of radiation and propagation mechanisms, and long-baseline interferometry is being used to investigate the sizes of the decametric sources. Observations have also been made

of Saturn, Venus, and Mars. The program is being further broadened by instrumental developments now under way.
Author (GRA)

N72-15775# Cornell Univ., Ithaca, N.Y.
INFRARED OBSERVATIONS OF DIFFUSE BACKGROUNDS
Martin O. Harwit, James R. Houck, Barrie W. Jones, Judith L. Pipher, and Baruch T. Soifer 10 May 1971 39 p refs
(Contract F19628-70-C-0128; ARPA Order 1366; AF Proj. 8692)
(AD-729454; AFCRL-71-0327; Rept-1) Avail: NTIS CSCL 03/2

The report consists of two parts and represents two scientific papers which present the results obtained in our December 2, 1970 flight: Rocket infrared observations of the interplanetary medium; Submillimeter observations of the night sky emission above 120 kilometers. Author (GRA)

N72-15776# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
OPTICAL IDENTIFICATION OF RADIO-SOURCES SELECTED FROM THE B2 CATALOG
G. Grueff and M. Vigotti 1971 101 p refs Submitted for publication
(Contract N00014-67-A-0094-0019)
(AD-729417) Avail: NTIS CSCL 03/2

Two samples of radio-sources, statistically complete to 0.25 and 0.90 Flux Units at 408 MHz is restricted areas, have been selected from the B2 Survey to attempt their optical identification on the Palomar Sky Survey. More accurate declinations have been measured for all the 487 radio-sources, using the interferometer of the Owens Valley Radio Observatory. The accuracy of the final radio-positions is of the order of 6 to 12 arc sec. in R. A., and 2.5 to 20 arc sec. in Dec. These positions have been located on the Palomar Sky Survey plates with an accuracy of 2 arc sec. Identification is suggested for the total of 104 radio-galaxies and 73 quasi-stellar objects. Finding charts and reference star positions are provided for all the fields investigated. Author (GRA)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N72-15777*# North American Rockwell Corp., Downey, Calif. Space Div.
SPACE SHUTTLE PHASE B EXTENSION, VOLUME 2 Technical Report, Sep. - Oct. 1971
12 Nov. 1971 712 p refs
(Contract NAS9-10960)
(NASA-CR-115285; MSC-03328-Vol-2; SD-71-342-Vol-2) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

Space shuttle systems are defined using a low technology orbiter combined with either an F-1 flyback booster or a pressure-fed booster. The mission and system requirements are given, and orbiter and booster configuration concepts are evaluated. Systems analyses and trades are discussed for LO2-RP propellent, F-1 engine main propulsion system, winged flyback recovery booster and for the pressure-fed, ocean recoverable, refurbishable booster system. Trade studies are also made for aluminum versus titanium orbiter and for crew location and compartment size. N.E.N.

N72-15778*# Translation Consultants, Ltd., Arlington, Va.
SOVIET "SOYUZ" SPACECRAFT
Washington NASA Jan. 1972 14 p Transl. into ENGLISH of the publ. "Sovetskiye Kosmicheskiye Korabli "Soyuz"" Leningrad, Nauka, 197 8 p
(Contract NASw-2038)
(NASA-TT-F-14104) Avail: NTIS CSCL 22C

The Soyuz program is discussed from the initiation through eight launchings, including the building of the world's first experimental space station. It is anticipated that Soyuz will, or could be, the basis for future developments in the field of permanent space stations. Author

N72-15779*# General Dynamics/Convair, San Diego, Calif.
A STUDY TO DETERMINE THE FLIGHT CHARACTERISTICS AND HANDLING QUALITITES OF VARIABLE GEOMETRY SPACECRAFT. VOLUME 3: LOW L/D CONCEPT WITH FOLD-DOWN WINGS
G. R. Friedman and B. J. Kuchta Washington NASA Jan. 1972 89 p refs
(Contract NAS1-7971)
(NASA-CR-1890; GDC-DDE68-003) Avail: NTIS CSCL 22B

A study was conducted to determine the flight characteristics and wing deployment transients for a variable geometry spacecraft concept having a hypersonic lift-to-drag ratio near 1.0, and employing fold-down wings. Unpowered flight conditions were considered throughout the study. The body of the spacecraft uses a trapezoidal cross section. The variable geometry wings, stowed in the sides of the vehicle, are deployed at transonic speeds. Author

N72-15780*# North American Rockwell Corp., Downey, Calif. Space Div.
SATURN S-2 PROBLEM RESOLUTION HISTORY REPORT
Frank W. Virgil Sep. 1971 604 p
(Contract NAS7-200)
(NASA-CR-123483; SD-71-256) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

A summary of S-2 Program problems and the solutions that were implemented is presented. The problems occurred during a period starting with the initial design concepts and continuing through the launch of the tenth S-2 flight stage information is from nine separate disciplines: design, facilities, logistics, manufacturing, material, program management, quality assurance, safety, and tests. Author

N72-15781*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REUSEABLE SPACE TRANSPORTATION SYSTEM Patent Application
Herman E. Thomason, inventor (to NASA) Filed 12 Nov. 1971 18 p
(NASA-Case-MFS-21527; US-Patent-Appl-SN-198380) Avail: NTIS CSCL 22B

The configuration of an aerospace vehicle for performing earth orbit missions and returning to reselected landing sites is presented. The vehicle consists of a large sweep-delta-wing booster with a smaller delta wing rocket orbiter vehicle in a piggyback arrangement. The orbiter has two detachable main external liquid hydrogen fuel tanks and internally mounted liquid oxygen tanks. It is intended to jettison the liquid hydrogen tanks after orbit is reached to improve spacecraft performance. The configuration allows a lower booster staging velocity which enables the booster to make extensive use of heat sink materials. NASA

N72-15782*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SPACE STATION MSFC-DPD-235/DR NO. CM-04 INTERFACE AND SUPPORT REQUIREMENTS
Dec. 1971 102 p
(Contract NAS8-25140)
(NASA-CR-121081; MDC-G2578) Avail: NTIS CSCL 22B

The interface and support performance, design and confirmation requirements are defined for the modular space

station and space shuttle programs. The requirements are treated as separate obligations against each modular program and are presented for the following: shuttle orbiter, shuttle booster, launch operations, mission operations, and the research applications module. F.O.S.

N72-15783*# Agence Tunisienne de Public-Relations, Tunis.
WAYS TO SPACEFLIGHT
Hermann Oberth Washington NASA Jan. 1972 608 p Transl. into ENGLISH of the book "Wege zur Raumschiffahrt" Munich-Berlin, 1929 Sponsored by NASA and NSF
(NASA-TT-F-622) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

A theoretical analysis of the parameters involved in spacecraft design and propulsion and the successful completion of space missions is presented. Various types of rockets and their specialized application are described. The physiological effects of space flight are discussed. The requirements for fuel, specific impulse, and energy considerations are included. Author

N72-15784*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SPACE STATION MSFC-DPD-235/DR NO. CM-02 SPECIFICATION, SPACE STATION PROJECT (MODULAR)
T. D. Smith Dec. 1971 94 p refs
(Contract NAS8-25140)
(NASA-CR-121082; MDC-G2554) Avail: NTIS CSCL 22B

The orbiting laboratory which can take many forms and can be configured to house a crew of up to 12 men is discussed. The initial study of the 33-foot-diameter Space Station, launched by the Saturn INT-21 and supporting a complement of 12 crewmen, has been completed and documented. A Modular Space Station comprised of smaller, shuttle-launched modules is described. These modules could ultimately be configured to provide for a crew of the same size as envisioned for the 33-foot-diameter Space Station-but buildup would be gradual, beginning with a small initial crew and progressing toward greater capability by adding modules and crewmen on a flexible schedule. Author

N72-15785*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SPECIFICATION, SPACE STATION PROGRAM (MODULAR)
Dec. 1971 71 p
(Contract NAS8-25140)
(NASA-CR-121084; MDC-G2553; MSFC-DPD-235/DR-CM-01) Avail: NTIS CSCL 22B

The modular concepts of a long-term manned scientific laboratory in earth orbit using the space shuttle for orbital buildup and logistics delivery are presented. The specifications defining the performance, design and verification requirements for the Modular Space Program are included. F.O.S.

N72-15786*# North American Rockwell Corp., Downey, Calif. Space Div.
ALTERNATE AVIONICS SYSTEM STUDY AND PHASE B EXTENSION Final Report
12 Nov. 1971 494 p
(Contract NAS9-10960)
(NASA-CR-115343; SD-71-346; MSC-03329) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Results of alternate avionics system studies for the space shuttle are presented that reduce the cost of vehicle avionics without incurring major off-setting costs on the ground. A comprehensive summary is provided of all configurations defined since the completion of the basic Phase B contract and a complete description of the optimized avionics baseline is given. In the new baseline, inflight redundancy management is performed onboard without ground support; utilization of off-the-shelf hardware reduces the cost figure substantially less than for the Phase B baseline. The only functional capability sacrificed in the new approach is automatic landing. G.G.

N72-15787*# North American Rockwell Corp., Downey, Calif. Space Div.
FIFTEEN-FOOT DIAMETER MODULAR SPACE STATION KENNEDY SPACE CENTER LAUNCH SITE SUPPORT DEFINITION (SPACE STATION PROGRAM PHASE B EXTENSION DEFINITION)
L. C. Bjorn, M. L. Martin, C. W. Murphy, and J. F. Niebla, V 23 Nov. 1971 354 p
(Contract NAS9-9953)
(NASA-CR-115320; SD-71-211; MSC-02465; Code-QN085282) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

This document defines the facilities, equipment, and operational plans required to support the MSS Program at KSC. Included is an analysis of KSC operations, a definition of flow plans, facility utilization and modifications, test plans and concepts, activation, and tradeoff studies. Existing GSE and facilities that have a potential utilization are identified, and new items are defined where possible. The study concludes that the existing facilities are suitable for use in the space station program without major modification from the Saturn-Apollo configuration. Author

N72-15788*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: AERODYNAMIC HEATING TESTS OF THE MDAC DELTA WING ORBITER AND CANARD BOOSTER
T. L. Andresen (MDAC-E) Jan. 1972 190 p
(Contracts NAS8-4016; NAS8-26016)
(NASA-CR-120007; DMS-DR-1170; Ser-H-0404.00; DRL-184-58) Avail: NTIS CSCL 22B

Design of an efficient thermal protection system for the space shuttle orbiter and booster is discussed, based on knowledge of the thermal environment to be experienced by the vehicles in all flight phases. The complex configurations of these vehicles limit the level of confidence which can be associated with purely analytical thermal environment predictions. Tests were conducted during April and May 1971 using an orbiter and booster model at a 96-in. hypersonic shock tunnel. Both models were tested separately as well as together. A sufficiently large range in Reynolds number was covered so that laminar, transitional, and turbulent data could be obtained. Author

N72-15789*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SPACE STATION (MODULAR) MISSION ANALYSIS. VOLUME 1: MISSION ANALYSIS
Nov. 1971 648 p refs
(Contract NAS8-25140)
(NASA-CR-121077; MDC-G2684-Vol-1; MSFC-DPD-235/DR-MP-01-Vol-1) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

The mission analysis on the modular space station considers experimental requirements and options characterized by low initial cost and incremental manning. Features that affect initial development and early operating costs are identified and their impacts on the program are assessed. Considered are the areas of experiment, mission, operations, information management, and long life and safety analyses. G.G.

N72-15790*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SPACE STATION (MODULAR) MISSION ANALYSIS. VOLUME 2: APPENDIX
Nov. 1971 414 p
(Contract NAS8-25140)
(NASA-CR-121078; MDC-G2684-Vol-2-App; MSFC-DPD-235/DR-MP-01-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The experiment requirements summary is prepared for use in manned space flight design studies and provides the basis for sizing space station, shuttle payloads, and experiment modules. Requirements are derived for a space station, and 30-day and 5-day shuttle missions. Author

N72-15791# Society of Environmental Engineering, London (England).
ENVIRONMENTAL ENGINEERING: THE EUROPEAN CONTRIBUTION
1970 310 p refs Proc. of the Anglo Dutch Symp., Delft, Neth., 1-3 Apr. 1970; sponsored by Delft Univ. of Technol.
Avail: NTIS HC $6.00/MF $0.95

Conference papers on aerospace environmental engineering are presented, emphasizing fatigue and reliability testing procedures. The structure and temperature control of spacecraft are highlighted. For individual titles, see N72-15792 through N72-15805.

N72-15792# European Space Research and Technology Center, Noordwijk (Netherlands). Structures Div.
DESIGN FOR SURVIVING THE SPACE ENVIRONMENT
R. Somoza *In* Soc. of Environ. Engr. Environ. Eng. 1970 39 p (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

The ways in which the space environment affect the design and development of spacecraft and their reliability are summarized. Two of the most important protection-giving systems, the structure and thermal control, are examined. ESRO

N72-15793# European Space Research and Technology Center, Noordwijk (Netherlands). Materials Section.
MATERIALS PROBLEMS IN SPACE
J. Dauphin *In* Soc. of Environ. Engr. Environ. Eng. 1970 20 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

The problems of spacecraft materials in the space environment are considered; among them are solar radiation effects, vacuum exposure, and thermal effects. Spacecraft environment factors are also mentioned. ESRO

N72-15794# Associated Semiconductor Manufacturers, Ltd., Southampton (England).
RELIABILITY: ITS IMPLICATIONS IN DESIGN, MANUFACTURE, AND TESTING c15
R. Brewer *In* Soc. of Environ. Engr. Environ. Eng. 1970 9 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

Among the concepts considered are reliability as a measure of quality, its relation to failure, statistical reliability, and reliability testing during manufacture. ESRO

N72-15795# Standard Telephone Cables, Cockfosters (England).
ENVIRONMENTAL SPECIFICATIONS c32
E. S. Ward *In* Soc. of Environ. Engr. Environ. Eng. 1970 9 p (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

The basic requirements and purposes of environmental specifications are discussed, and the difference between component and equipment specifications is noted. Reference is made to the IEC, and guidance in the use of specifications is given. ESRO

N72-15796# Siemens A.G., Munich (West Germany). Zentrallab. fuer Nachrichtentechnik.
THE EFFECT OF ELECTROMAGNETIC ENVIRONMENTAL CONDITIONS ON THE TRANSMISSION OF ELECTRIC SIGNALS WITH SPECIAL REFERENCE TO DATA TRANSMISSION c07
W. Vogl and E. Popp *In* Soc. of Environ. Engr. Environ. Eng. 1970 13 p (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

The ways in which the electromagnetic compatability of adjacent equipment can be improved are discussed, and the types and causes of reciprocal influence are examined. Interference is also considered, and suppression methods such as filtering the power supply lines and line shielding are given. ESRO

N72-15797# British Aircraft Corp., Weybridge (England). Acoustics Lab.
ACOUSTIC TESTING, AIRCRAFT STRUCTURES c32
John A. Hay *In* Soc. of Environ. Engr. Environ. Eng. 1970 27 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

Acoustic fatigue testing is outlined for aircraft structures, and the mechanism and causes of the phenomenon are discussed. Common forms of test facilities and methods of testing are reviewed. ESRO

N72-15798# Northern Technological Inst. Haren (Netherlands). Vibration and Stress Analysis Dept.
SOME SPECIAL PROBLEMS IN VIBRATION AND SHOCK ISOLATION c32
A. J. Francken *In* Soc. of Environ. Engr. Environ. Eng. 1970 22 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

Factors such as isolation as a coupling of dynamic systems and the mobility of the insert are considered. Shock is broken down into three types; acceleration, velocity, and position. ESRO

N72-15799# Institutet foer Miljoeteknik, Stockholm (Sweden).
SHOCK AND BUMP TESTING c32
K. Spaang *In* Soc. of Environ. Engr. Environ. Eng. 1970 12 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

Basic aspects of shock and bump testing are considered with regard to the shock spectrum. The choice of pulse shapes for shock testing is also discussed. ESRO

N72-15800# Metaalinstituut TNO, Delft (Netherlands). Metal Finishing and Corrosion Dept.
ATMOSPHERIC CORROSION OF METALS c17
J. W. Boon *In* Soc. of Environ. Engr. Environ. Eng. 1970 19 p (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

So that the atmospheric attack on metals can be understood, some fundamental facts about corrosion are given, including the potential jumps at metal-liquid interfaces, galvanic currents, and polarization. Forms of corrosion are given, and methods for measuring and predicting the corrosion of exposed metals and alloys, as well as means of protection, are discussed. ESRO

N72-15801# Technische Hogeschool, Delft (Netherlands).
DETERMINISTIC VERSUS STOCHASTIC SIGNALS c09
R. G. Boiten *In* Soc. of Environ. Engr. Environ. Eng. 1970 59 p (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

A test program representation of the actual service conditions of electronic equipment is presented so that the equipment behavior can be predicted in the shortest time. Factors influencing the environment are considered dependent on time, and functions or signals are used for the tests. Methods for comparing time signals are given, and an insight into covariance functions is also given by use of Fourier transformations. Determination and changes in stochastic signals are presented, and methods for checking the signal by determining the spectral density and probability distribution function are considered. The generation of stochastic signals is briefly noted. ESRO

N72-15802# Brueel and Kjaer, Naerum (Denmark).
SOME ASPECTS OF VIBRATION TESTING c32
Jens T. Broch *In* Soc. of Environ. Engr. Environ. Eng. 1970 27 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

The three principle methods of vibration testing, frequency sweep, wideband random, and sweep random, are considered. The derivation of vibration test specifications are noted, as are mechanical impedance considerations. ESRO

N72-15803# Institute TNO for Mechanical Constructions, Delft (Netherlands).
ANALYSIS OF RESPONSE OF STRUCTURES TO VIBRATION ENVIRONMENT c32
H. H. Hart *In* Soc. of Environ. Engr. Environ. Eng. 1970 21 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

The dynamic characteristics of structures are examined by analyzing their response to given excitations. The response is determined by the mobility method with algebraic network equations. The mobilities of three dynamic systems, damper, mass, and spring, are calculated and used as an illustration of the method. ESRO

N72-15804# Institute TNO of Applied Physics, Delft (Netherlands).
APPLICATION OF LASERS FOR DEFORMATION AND VIBRATION ANALYSIS c16
H. J. Raterink *In* Soc. Of Environ. Engr. Environ. Eng. 1970 15 p (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

An optical alignment method for the measurement of small displacements and deformations is described, together with a laser vibration meter for measuring very small vibration amplitudes without mechanical contact. A holographic interferometric technique for vibration and deformation analyses is also outlined. ESRO

N72-15805# Atomic Weapons Research Establishment, Aldermaston (England).
ACCELERATED VIBRATION TESTING c32
J. A. L. Yarnold *In* Soc. of Environ. Engr. Environ. Eng. 1970 16 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

Vibration testing is considered and related to failure of electronic equipment, along with accelerated fatigue testing. Fatigue as a purely chance phenomenon is also reviewed. ESRO

N72-15806*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
PHASE C/D PROGRAM DEVELOPMENT PLAN. VOLUME 1: PROGRAM PLAN
Dec. 1971 37 p refs 2 Vol.
(Contract NAS8-25140)
(NASA-CR-121083; MDC-G2539-Vol-1; MSFC-DPD-235; DR-MA-05) Avail: NTIS CSCL 22B

The Phase C/D definition of the Modular Space Station has been developed. The modular approach selected during the option period was evaluated, requirements were defined, and program definition and preliminary design were accomplished. The Space Station Project is covered in depth, the research applications module is limited to a project-level definition, and the shuttle operations are included for interface requirements identification, scheduling, and costing. Discussed in detail are: (1) baseline program and project descriptions; (2) phase project planning; (3) modular space station program schedule; (4) program management plan; (5) operations; (6) facilities; (7) logistics; and (8) manpower. A.L.

N72-15807*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SPACE STATION MSFC-DPD-235/DR NO. MA-05 PHASE C/D PROGRAM DEVELOPMENT PLAN. VOLUME 2: PHASE C/D, PROGRAMMATIC REQUIREMENTS
Dec. 1971 446 p refs 2 Vol.
(Contract NAS8-25140)
(NASA-CR-121085; MDC-G2539-Vol-2; MSFC-DPD-235; DR-MA-05) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The design plan requirements define the design implementation and control requirements for Phase C/D of the Modular Space Station Project and specifically address the Initial Space Station phase of the Space Station Program (modular). It is based primarily on the specific objective of translating the requirements of the Space Station Program, Project, Interface, and Support Requirements and preliminary contract end x item specifications into detail design of the operational systems which comprise the initial space station. This document is designed to guide aerospace contractors in the planning and bidding for Phase C/D. Author

N72-15808# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF LINEAR FILTERING TECHNIQUES TO ATTITUDE RECONSTITUTION FOR SPINNING SATELLITES [APPLICATION DES TECHNIQUES LINEAIRES DE FILTRAGE A LA RECONSTITUTION D'ATTITUDE DE SATELLITES EN ROTATION]
H. T. Huynh, F. Depasse, and C. Aumasson Paris ESRO Jan. 1971 144 p refs In FRENCH; ENGLISH summary
(Contract ESTEC-1179/70)
(ESRO-CR-37) Avail: NTIS

The attitude reconstitution of a satellite spinning about its axis of revolution consists in estimating the direction of angular momentum from information provided by a solar sensor and an earth sensor, the data being processed on the ground. The measurements are perturbed by errors of various kinds (random, systematic, quantization) and are nonlinear functions of the unknown state vector. The use of linear filtering techniques can still be tried, however; this is done by linearizing the measurement functions while hoping that the presence of nonlinear terms, which are neglected in the calculations, will not unduly affect the value of the parameter estimated. Numerical results of a simulation aiming at verifying this hypothesis are presented. It consists of three parts: (1) description of the model used for the simulation of the measurements provided by the sensors; (2) definition of the parameters to be estimated and presentation of the methods used for parameter estimation; and (3) description of the numerical results obtained. Author (ESRO)

N72-15809# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RESPONSE OF STRUCTURAL SYSTEMS TO NONSTATIONARY RANDOM EXCITATION
David C. Hyland 7 Sep. 1971 191 p refs
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-731159; TN-1971-39; ESD-TR-71-261) Avail: NTIS CSCL 22/2

In this work, the response of lumped parameter, second order systems to nonstationary random excitations is examined. Included is a brief introduction to the probabilistic theory of structural dynamics and various basic concepts required for subsequent work. More specifically, the second order central moment (covariance) response of structural systems to random excitations is studied. In the course of the analysis, an approximate method for the calculation of system response to a class of nonstationary excitation processes is constructed. This class of excitations the author has called 'slowly varying' nonstationary random processes. By this is meant that the nonstationary variation of the correlation functions of the process is small compared with the time variation of the impulse response functions of the system considered. It is shown how this approximation technique may be applied to the estimation of inertial loads in the structural members of a payload during the launch phase of flight. Employing loads in the structural members of a payload during the launch phase of flight. Employing previous rocket engine test data, the excitations to the payload are idealized as a 'slowly varying' nonstationary random excitation. An approximation procedure is then developed for the calculation of the second-order central moments of the payload response. Author (GRA)

N72-15810# Army Materiel Command, Redstone Arsenal, Ala.
A METHOD OF TRANSFORMING TRAJECTORY DATA FROM ONE GEOGRAPHIC ORIGIN TO ANOTHER
James C. Harrington 4 Jun. 1971 18 p
(Proj. SAM-D)

(AD-730900) Avail: NTIS CSCL 16/2

The report contains mathematics, parameters, and procedures which can be utilized to transform position, velocity, and acceleration data expressed in rectangular coordinates at one geographic origin to those expressed in rectangular coordinates at another geographic origin. It also contains mathematics for computing additional trajectory parameters with respect to the new origin. Author (GRA)

N72-15811# Ballistic Research Labs., Aberdeen Proving Ground, Md.

GRAVITY-INDUCED ANGULAR MOTION OF A SPINNING MISSILE

Charles H. Murphy Jul. 1971 59 p refs

(RDT/E Proj. 1T2-62301-A-201)

(AD-730641; BRL-1546) Avail: NTIS CSCL 19/1

The usual analysis of the steady state angular motion of a dynamically stable spinning missile assumes a quasi-steady state calculation of a gravity-induced trim angle. A condition for the validity of this quasi-steady state assumption is derived. When this condition is not satisfied, the gravity-induced angular motion must be described differently for three distinct portions of the trajectory: the upleg, near apogee, and the downleg. The accuracy of this description is checked by comparison with numerical integrations. Finally the influence of cubic static and Magnus moments on the motion is determined and a revised point mass trajectory model is constructed. Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N72-15812 Shock and Vibration Information Center (Defense), Washington, D.C.

THE SHOCK AND VIBRATION BULLETIN, NO. 40. PART 2: SHOCK

Dec. 1969 255 p Presented at 40th Symp. on Shock and Vibration, Fort Monroe and Hampton, Va., 21-23 Oct. 1969 7 Vol.

(AD-723341; Bull-40-Pt-2) Avail: Director, Navy Publ. and Printing Serv. Office, Naval District Of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Data covering experimental results and design recommendations for structures and equipment subjected to shock and vibration are presented. Detailed descriptions are given for such effects on fluid systems, aircraft structures, gas turbines, helicopter structures, and protective buildings. For individual titles, see N72-15813 through N72-15832.

N72-15813 Naval Research Lab., Washington, D.C.

AN EXPERIMENTAL APPROACH TO UNDERSTANDING SHOCK RESPONSE

Merval W. Oleson *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 1-19 refs (See N72-15812 06-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A theoretical approach to interpreting shock response measurements is presented. The approach uses differential displacement across structural elements. Illustrations are given for the measurement programs used along with arguments used to justify the theory. E.H.W.

N72-15814 Martin Marietta Corp., Orlando, Fla.

EXPLOSIVE SHOCK

William H. Roberts *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 21-30 refs (See N72-15812 06-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390: $15.00/set

The principle dynamic characteristics responsible for failure in missile structure and equipment are examined. Three approaches, time history, shock spectrum, and Fourier spectrum measurements, were used. Results indicate failure was caused by (1) imposition of abrupt load front externally, (2) an oscillating load transmitted internally through structure, (3) resonant response, and (4) high stresses at high frequencies. It was also discovered that mid frequencies cause the greatest equipment damage. E.H.W.

N72-15815 Naval Civil Engineering Lab., Port Hueneme, Calif.

MODAL VELOCITY AS A CRITERION OF SHOCK SEVERITY

H. A. Gaberson and R. H. Chalmers (Naval Electron. Lab. Center) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, pt. 2 Dec. 1969 p 31-49 refs (See N72-15812 06-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The problems, high frequency accelerations and instrument errors of analyzing spectral shock response data are examined. Stress mechanisms of longitudinal waves in rods and tranverse waves in beams are analyzed in an effort to solve these problems. Results indicate that modal stress is a function of velocity and independent frequency. Thus, modal velocity singly predicts stress. It was recommended that a more adequate velocity transducer be developed, and that modal velocity be used as a severity criterion while velocity is used as a prime shock measurement parameter. Author

N72-15816 Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.

THE SIMULTANEOUS APPLICATION OF TRANSIENT AND STEADY STATE DYNAMIC EXCITATIONS IN A COMBINED ENVIRONMENT REST FACILITY SIMULATING SHIPBOARD ENVIRONMENTS

T. B. Jones, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 51-55 refs (See N72-15812 06-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A design concept was established for a combined environment test facility in the facility, transient and steady-state dynamic excitations are effected simultaneously by a system of multiple electrodynamic shakers in conjunction with a two-axis gimbaled drive system which effects pitch and roll maneuvers. The facility is designed to simulate Navy shipboard environments and to impose required environmental test conditions on Navy electronic equipments. The subject matter is limited to the consideration of design and analysis of the dynamic excitation systems. The systems are designed for a maximum test load of 25,000 pounds and are capable of effecting shock excitations in the range of 5-20 g's as well as imposing requisite vibratory and oscillatory excitations. Author

N72-15817 Northwestern Univ., Evanston, Ill.

PERIODIC SHOCK EXCITATION OF ELASTIC STRUCTURES

Dusan Krajcinovic (Ingersoll-Rand Res., Inc.) and George Herrmann *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 57-66 refs (See N72-15812 06-32)

(Grant AF-AFOSR-0100-67)

Avail: NTIS Avail: Director, Navy Publ. and Printing Serv.

Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The dynamic stability of elastic structures subjected to various types of periodic shock excitation is investigated. Exact and series solutions of the linearized problem of parametric resonance are given. The finite element formulation of the problem is briefly outlined. The analysis is illustrated by a thinwalled beam subjected to a transverse pulsating force.
Author

N72-15818# University of Southern Calif., Los Angeles.
SHOCK ANALYSIS OF FLUID SYSTEMS USING ACOUSTIC IMPEDANCE AND THE FOURIER TRANSFORM; APPLICATION TO WATERHAMMER PHENOMENA c12
Arthur A. Winquist and Raymond C. Binder *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 67-81 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The problem of applying the Fourier transform method to fluid systems is examined. An important general problem in practice is the transient response of a liquid system subjected to a shock input, due to a variable constriction or changing valve condition in the line. This type of problem is classed as water hammer of fluid hammer. Using acoustic impedance and the Fourier transform in a digital computer program, waterhammer excess pressure head resulting from valve closure at the end of a straight pipe was calculated for several cases. Results of this theoretical analysis are compared with experimental data and with results using traditional water hammer solution techniques. The acoustic impedance-Fourier transform technique proved to be a completely valid method of calculating system excess pressure head for the water hammer cases discussed. Calculated excess pressure head was closely comparable to the excess pressure experienced in actual experimental tests and the excess pressure head using traditional solution techniques. The Fourier technique satisfies an existing requirement for an alternate approach to the present laborious methods used in calculating water hammer excess pressures. This method can be applied to various fluid power and control systems, for small or large pipes.
Author

N72-15819 Defence Research Establishment Suffield, Ralston (Alberta).
DRAG ON FREE FLIGHT CYLINDERS IN A BLAST WAVE c01
Stanley B. Mellsen *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 83-99 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The free flight method was used to obtain the drag coefficients for circular cylinders in the blast wave from a 500 ton spherical TNT burst. The measurements were made on each of two 3 1/2 inch diameter aluminum cylinders, three feet long, placed at the 12.0 and 8.5 psi peak overpressure locations respectively. The average drag coefficients obtained over the first 50 milliseconds of the blast wave were 0.67 and 0.48 for the 12.0 and 8.5 psi locations respectively.
Author

N72-15820 Mechanics Research, Inc., Los Angeles, Calif.
ANALYTICAL AND EXPERIMENTAL RESULTS OF LATTICE TYPE STRUCTURES SUBJECTED TO A BLAST LOADING
Robert Geminder *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 101-114 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The results of a program in which three antenna mast structures were designed, fabricated, and subjected to a detonation of 500 tons of TNT are presented. The masts were instrumented, and the experimental data was compared with the analytically predicted results. A final analytical result was obtained which integrated the experimental results with the analytical predictions.
Author

N72-15821 Idaho Univ., Moscow. Dept. of Civil Engineering.
LATERAL RESPONSE OF SLIGHTLY CURVED COLUMNS UNDER LONGITUDINAL PULSE LOAD
Thomas L. Anderson and Martin L. Moody (Colo. Univ., Denver) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 115-122 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Response spectra for the transient lateral vibrations of columns of slight initial curvature are presented. The bending vibrations are induced parametrically by the following longitidinal pulse loads: (1) zero rise-linear decay, (2) linear rise-linear decay, (3) rectangular, and (4) linear rise-constant. Selected individual transient solutions are shown, and certain nonlinear effects to account for large displacements and the effect of a mass attached to the end of the column are included and compared with the linear case. Under certain conditions, the addition of damping to the system is found to result in an increased response.
Author

N72-15822 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
RESPONSES OF AIRCRAFT STRUCTURES SUBJECTED TO BLAST LOADING
Nelson M. Isada, Richard K. Koegler, and Donald O. Bliven *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 123-132 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The responses of aircraft structural elements subjected to blast loading were studied. The nature and extent of damage of concern for representative aircraft structures were established to define the specific regions and load distributions to be investigated. After this was done, it was found feasible to use both a linear and a nonlinear (to consider the plastic effects) dynamic response analysis in predicting the transient blast loading required to cause failure in specified structural components. The prediction is carried out by means of structural isodamage curves that were constructed for this study and discussed in this paper.
Author

N72-15823 Bell Telephone Labs., Inc., Whippany, N.J.
PREDICTION OF BLAST VALVE RESPONSE USING MODELS
R. G. McCoy, G. Nevrincean, and E. F. Witt *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 133-146 (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A louvre blast valve was developed for use in Bell System underground communication buildings to prevent air blast from possible nuclear detonations from entering air entrances and exits. Because of the complex blast flow and resulting stresses during valve closure, the valve principle was demonstrated using a 1/4-scale model in Chester shock tube. Extensive data were obtained on stresses and closing times and compared well with subsequent data from tests on full size valves in a 6 foot diameter shock tube. Improved prototype valves were then tested successfully in Operation Prairie Flat (a simulated nuclear detonation), demonstrating the value of prior shock tube testing.
Author

N72-15824 Defence Research Establishment Suffield, Ralston (Alberta).
TESTING THE RESPONSE OF GAS TURBINES TO AIR BLAST c28
J. C. Muirhead, R. Naylor, and C. G. Coffey *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 147-156 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The effect of blast on gas turbine engines is explored. Exploratory experiments used an Orenda 8 engine, which was subjected to blast waves from a valve-operated, compressed air driven shock tube. No significant effects were caused by inlet loadings, but blast waves impinging on the exhaust caused compressor stall and flame-out at low rpm. A general review of the program is given. Author

N72-15825*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRANSIENT WAVEFORM CONTROL OF ELECTROMAGNETIC TEST EQUIPMENT c10
John D. Favour (Boeing Co., Seattle), Jay M. LeBrun (Boeing Co., Seattle), and Joseph P. Young *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 157-171 refs (See N72-15812 06-32)
(Contract NAS5-15171)
(NASA-TM-X-67588) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 09C

A technique by which electromagnetic exciters are controlled to produce specific time-history transient waveforms is discussed. The technique utilizes an on-line digital computer in a near real time configuration. A recently developed fast Fourier transform algorithm forms the operational foundation of the technique. A prototype transient waveform control system was assembled and tested. That prototype system and its performance are discussed. Author

N72-15826 Texas Instruments, Inc., Dallas.
AN IMPROVED ELECTRODYNAMIC SHAKER SHOCK TECHNIQUE c14
J. R. Moser and D. Garner *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 173-181 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Details are given of how a shaker/amplifier was frequency compensated to achieve the same pulse at the output as in the input. This was done by using real time pulse at the system input. It was demonstrated that standard laboratory pulse generators rather than the cumbersome waveform synthesizers could be used. The time required to do the test is estimated to be one-third of that required using the present state of the art technique. A circuit was presented which allows in-lab construction of the required inverse shaping filter. Recommendations were made for including a full-sine shock pulse in MIL-STD-810B as an option when performing shock tests on electrodynamic shakers. Author

N72-15827*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROTUBERANCE EFFECTS ON LIMITER EQUIPPED HARD LANDING PAYLOADS
John L. McCarty and James T. Howlett *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 183-191 refs (See N72-15812 06-32)
(NASA-TM-X-67589) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20K

An analytical and experimental study was conducted to evaluate the effects of surface protuberances, such as rocks, on impact limiters for hard landing payloads. The analytical phase consisted of extending an existing analysis to include protuberances and the application of this extended analysis to establish the effect of protuberances on impact limiter design. The experimental phase was undertaken to validate the analysis and consisted of impacting fullscale (for a prospective Mars mission) hard lander configurations, equipped with balsa wood as an impact limiter, onto a rigid planar surface having cylindrical and conical protuberances. The experimental test results substantiate the capability of the analysis to predict the effect of surface protuberances on the design and behavior of the impact limiter. Author

N72-15828 Sandia Labs., Albuquerque, N.Mex.
IMPACT TESTS OF NUCLEAR FUEL MATRICES USING A VACUUM TUBE LAUNCHER c22
H. W. Nunez *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 193-204 (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Details are given of a vacuum tube launcher (VTL) and its operation. The VTL uses the small difference between atmospheric pressure and a vacuum as the force to propel a piston through a tube. The interesting features are the radioactive nuclear fuel being tested and the precautions necessary to handle the fuel. The method of obtaining the required impact conditions is discussed as are the calibration shots used to determine the functional parameters of the VTL and to verify the attitude of the nuclear fuel puck at impact. Author

N72-15829 Endevco Corp., Pasadena, Calif.
DEVELOPMENT OF 100000 g TEST FACILITY c11
Robert L. Bell *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 205-214 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A mechanical amplifier was built to produce high accelerations - on the order of 100,000 g - for survival testing of accelerometers. Theoretical calculations underlying the design of the facility are included. Data and results of the actual testing show reasonable agreement between experiment and theory. Absolute calibration of the apparatus was not undertaken. Accelerometers calibrated by the comparison technique at low g's were used to indicate the output. These devices have indicated accelerations in excess of 100,000 g can be generated by the shock bar. Author

N72-15830 General Electric Co., Philadelphia, Pa.
ON THE INTERPRETATION AND APPLICATION OF SHOCK TEST RESULTS IN ENGINEERING DESIGNS
Chi-Hung Mok *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 215-226 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A theoretical study of the characteristics of a shock spectrum which is measured in a shock test of equipment is presented. For this purpose, the machine and the equipment are represented by two systems connected in series; an upper and a lower bound of the spectrum of the shock motion at the interface of the two systems are found using the Fourier transform and impedance method. The spectrum is shown to be affected by the characteristics of both systems. It is demonstrated that in a system containing negligible damping, hills would occur in the spectrum at the resonant frequencies of the combined system whereas valleys (spectrum dips) would appear in the

neighborhood of the fixed base resonant frequencies of the equipment. The possible effects of damping and of the variation in the characteristics of the system on the phenomenon are also discussed. The results support, at least in the case of systems with low damping, the current design practice of the Navy in which an envelope of a group of the dips of measured spectra is used in creating a design spectra for similar equipment. The analysis developed here would also be useful in understanding the behavior of vibration absorber and other shock phenomena.
Author

N72-15831 Southwest Research Inst., San Antonio, Tex.
METHODS OF COMPUTING STRUCTURAL RESPONSE OF HELICOPTERS TO WEAPONS' MUZZLE AND BREECH BLAST c02
W. E. Baker, S. Silverman, P. A. Cox, Jr., and D. Young *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 227-241 refs Sponsored by Army Ballistics Res. Labs. (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Methods are presented for computing the response of helicopter structures to muzzle and breech blast from weapons located on or near the aircraft. The current state of knowledge is reviewed and techniques for applying existing response analyses and developing new analysis methods where existing ones are inadequate, are given. Finally, computer codes for predicting response in the elastic and plastic regimes of various elements and major components of helicopter structures are described.
Author

N72-15832 Army Corps of Engineers, Huntsville, Ala.
SHOCK TESTING FOR EQUIPMENT IN PROTECTIVE STRUCTURES
M. M. Dembo and C. C. Huang *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 2 Dec. 1969 p 243-250 refs (See N72-15812 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A new shock test system which was developed to simulate the predicted shock environment induced by nuclear weapons is described. The test system was developed as part of the SAFEGUARD Facility Equipment Test Program. The induced environment was predicted by dynamic analysis. The shock test system consists of an electrohydraulic exciter and complex waveform synthesizer.
Author

N72-15833 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN NO. 40. PART 6: TRANSPORTATION
Dec. 1969 162 p refs Presented at the 40th Symp. on Shock and Vibration, Fort Monroe and Hampton, Va., 21-23 Oct. 1969 7 Vol.
(AD-723345; Bull-40-Pt-6) Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Conference papers are presented on various shock and vibration studies, encompassing ejected missiles, aircraft noise, and aircraft landings. Rail transportation at high speeds is also evaluated for human comfort. For individual titles, see N72-15834 through N72-15846.

N72-15834 Boeing Co., Seattle, Wash. Aerospace Div.
SIMULATION OF DYNAMIC LOADS ON EJECTED MISSILES
Clifford R. Perry *In* Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 1-7 (See N72-15833 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Test techniques are discussed for producing environments for measuring the velocities, strain, translation, pitch rates, gas pressures, accelerations, and dynamic structural models. The structural design of the missile ejection bed and the design of an arrest mechanism which would arrest the missile at less than the ejection g load with no damage to the missile itself were accomplished. The reaction structure and the arresting mechansims were built, and the tests were completed. A total of 40 simulated ejections and arrests were performed.
Author

N72-15835 Honeywell, Inc., Hopkins, Minn. Ordnance Div.
WIND TUNNEL SIMULATION OF FLIGHT VIBRATION AND ACOUSTIC LEVELS ON AN EXTERNAL STORE
K. A. Herzing and S. N. Schwantes *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 9-25 refs (See N72-15833 06-32)
(Contract F08635-69-C-0148)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A prototype munitions dispenser designed for external carriage on tactical aircraft was tested in a wind tunnel to verify the structural integrity of several modifications. As a result of the wind tunnel test, it appears feasible to utilize to utilized a wind tunnel to subject an external store to representative flight vibration and acoustic levels. The tunnel must be capable of providing flow conditions over the full design flight regime. The store described was also tested in two configurations subject to cavity resonance. Comparisons are made to flight data and a conventional random vibration test using an electrodynamic shaker.
Author

N72-15836 Vought Aeronautics, Dallas, Tex.
A METHOD TO SIMULATE GUNFIRE INDUCED VIBRATION ENVIRONMENT
J. A. Hutchinson and R. N. Hancock *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 27-35 refs (See N72-15833 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Samples of measured flight nongunfire and gunfire data obtained from the M61 rapid-fire gun in the A-7D airplane are presented. It defines a basic procedure for simulating the gunfire environment in the vibration laboratory through the use of a pulse train input function. To substantiate this method, the results of two laboratory tests are given. Conclusions are presented based upon the results of these laboratory tests concerning the repeatability of the test input spectrum and the accuracy of the gunfire simulation. It is recommended that a test of this type be used to supplement the tests defined by current military specifications governing vibration qualification for equipment located in the vicinity of large caliber, rapid-fire gun systems.
Author

N72-15837 Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
THE SHOCK AND VIBRATION EXPERIENCED BY NAVAL AVIONICS DURING ARRESTED LANDING c02
Vaughn M. Foxwell, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 37-59 (See N72-15833 06-32)
Avail: NTIS Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The problem was investigated and the environment defined through a flight test program. Subsequent to the environmental definition, a design fix was implemented consisting of additional mounts and snubbers to limit high excursion without degrading normal vibration isolation characteristics. The investigation revealed that MIL-E-5400 did not completely define the rigorous shock and vibration environment of carrier-based aircraft.
Author

N72-15838 Tustin Inst. of Tech., Santa Barbara, Calif.
A SURVEY OF PRACTICAL PROBLEMS ENCOUNTERED IN REPRODUCING THE CAPTIVE FLIGHT ENVIRONMENT BY MEANS OF SHAKERS AND SHOCK TEST MACHINES c11
Wayne Tustin *In* Shock and Vibration Inform. Center .The Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 61-66 refs (See N72-15833 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Attention is paid to tests on partial and complete weapons and stores which are carried to their missions by aircraft. Test specifications, particularly the catalog variety, are questioned. Methods for attaching test items are discussed. Various techniques for selecting accelerometer locations and for utilizing multiple accelerometer signals are mentioned. Effects of tracking filters, of distorted motion, and of crosstalk on the outcome of tests are mentioned. Advantages of acoustic and wind tunnel environmental testing are mentioned. Author

N72-15839 General Dynamics/Pomona, Calif.
STANDARD ARM CAPTIVE CARRY LIFE EXPECTANCY PREDICTION AND VIBRATION QUALIFICATION TESTING
B. N. Downing *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 67-83 refs (See N72-15833 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390: $15.00/set

Imposing classical testing methods for qualification of the air-launched standard ARM missile for the captive carry vibration environment resulted in a major airframe fatigue failure and identification of the critical structural element. An overtest was clearly demonstrated by actual life expectancy studies. A tactical air carry mission model was synthesized from the most significant flight phases characteristic of the parent A-6B Intruder aircraft. Environmental measurements were made with a fully-instrumented missile for each phase and presented by peak bending moment distribution graphs. Laboratory tests were conducted to define the fatigue properties of the critical airframe element. Conventional analyses of the fatigue and environmental data indicated, with inherent conservatism, a captive carry life expectancy of 850 hours; a relatively generous duration for this type of weapon. Force excitation concepts were used in the design of a revised missile level qualification test which was successfully performed. Improvements offered by the test and validity of assumptions are discussed. Author

N72-15840 Army Transportation Engineering Agency, Fort Eustis, Va. Military Traffic Management and Terminal Service.
RAILROAD TRANSPORTABILITY CRITERIA
Robert Kennedy *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 85-89 (See N72-15833 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Transportability criteria will standardize the output of individual test programs so that data and results have broad application and can be used for cross analysis and cross checking those developing transportability criteria and preparing transportability guidance pertaining to shock and vibration. Test procedures were grouped into three methods. For each method, emphasis is given to complexity of test facilities and technical depth required for analysis, instrumentation, and reporting. Author

N72-15841*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASURED VIBRATION RIDE ENVIRONMENTS OF AN STOL AIRCRAFT AND A HIGH SPEED TRAIN
John J. Catherines *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 91-97 refs (See N72-15833 06-32)
(NASA-TM-X-67586) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20K

Ride environments of several models of transportation were measured and analyzed in an effort to establish the relationship of the vibration levels to human comfort. A small, inexpensive, FM recording system was developed to record the vibratory accelerations of the vehicles. Acceleration measurements are presented in the form of peak accelerations, power spectral density, and histograms. Results show that the ride environments are characterized by low-frequency responses. Preliminary results show good correlation between peak accelerations and subjective responses of passenger with the lateral accelerations causing more discomfort than the vertical accelerations. Author

N72-15842 Army Transportation Engineering Agency, Fort Eustis, Va. Military Traffic Management and Terminal Service.
THRESHOLD TYPE RECORDERS c14
J. J. Pursifull *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 99-107 (See N72-15833 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Certain requirements for instrumentation to identify and record critical elements required in the development of transportation systems performance standards are discussed. Two factors are considered: (1) the type of data and degree of accuracy and (2) the physical properties of the instrumentation. Three threshold-type systems are evaluated: the grav-a-graf, the statistical shock recorder, and the TEMARS (Transportation Environmental Measurement and Recording System). Author

N72-15843*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RAIL VEHICLE DYNAMIC STUDIES
John L. Sewall, Russell V. Parrish, and Barbara J. Durling *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 109-126 refs (See N72-15833 06-32)
(NASA-TM-X-67587; L-6954) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390, $15.00/set CSCL 20K

Simplified dynamic models are applied to the problem of ride comfort in tracked vehicles for high-speed passenger travel. The studies are aimed at the adequate simulation of significant degrees of freedom in a railroad car in order that optimum stiffness and damping characteristics of the car and its truck suspension may be found for improved ride quality. The mathematical models are a four-degree-of-freedom vertical model and a 10-degree-of-freedom lateral model. The vertical model is subject to vertical inputs applied simultaneously to both trucks, and the lateral model is subject to lateral and/or rocking (or cross-level) displacements from the rails. Responses to these inputs, which may be deterministic or random, are obtained in acceleration units for various parts of the system. More emphasis is given to the lateral than to the vertical model and also to responses in the car than in other parts of the system. Nonlinear spring characteristics are simulated in two parts of the lateral truck suspension system. Author

N72-15844 Michigan State Univ., East Lansing. School of Packaging.
A PROCEDURE FOR DETERMINING DAMAGE BOUNDARIES
James W. Goff and Stephen R. Pierce *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 127-130 refs (See N72-15833 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval

District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A procedure for determining the damage boundary was developed and applied to a number of different items. Damage boundary plots were prepared for a television set, several different refrigerators, an alarm clock, an industrial control, an automobile part, an electric typewriter and several other articles.
Author

N72-15845 Shock and Vibration Information Center (Defense), Washington, D.C.
EVALUATION OF A FRAGILITY TEST METHOD AND SOME PROPOSALS FOR SIMPLIFIED METHODS
Edward H. Schell *In its* Shock and Vibration Bull., No. 40, Pt. 6 Dec. 1969 p 133-152 refs (See N72-15833 06-32)
(AF Proj. 69-28-D-38)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A digital simulation of a test was performed on 25 packages based on fragilities obtained in accord with the proposed method. Findings indicate that results may be obtained which are highly conservative in some cases and highly nonconservative in others. The study also indicates that a terminal peak sawtooth waveform is superior to the rectangular waveform for fragility testing. Several methods for simple fragility tests are given, and a proposal is made for extending general equipment environmental tests to determine failure levels.
Author

N72-15846 Shock and Vibration Information Center (Defense), Washington, D.C.
FRAGILITY
In its Shock and Vibration Bull., no. 40, pt. 6 Dec. 1969 p 153-159 (See N72-15833 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A panel discussion on fragility in packaging is presented. Various fragility tests procedures are examined, including acceleration and impact tests.
J.A.M.

N72-15847 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN NO. 40. PART 7: INSTRUMENTATION AND DATA ANALYSIS
Dec. 1969 249 p refs Proc. of the 40th Symp. on Shock and Vibration, Fort Monroe, Va. and Hampton, Va., 21-23 Oct. 1969 7 Vol.
(AD-723346; Bull-40-Pt-7) Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Measuring instruments and methods for analyzing dynamic responses of structures to vibratory and shock loads are reported. Considerable interest is focused on computerized simulation and data processing systems. For individual titles, see N72-15848 through N72-15869.

N72-15848 Arizona State Univ., Tempe.
THE RESPONSE OF TRANSDUCERS TO THEIR ENVIRONMENT: THE PROBLEM OF SIGNAL AND NOISE c09
Peter K. Stein *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 1-16 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The problem of how transducers respond to their environment, and to the deliberate design of measuring systems so that only the desired response to the desired environmental aspect is achieved is considered. Since every link in the measuring chain is capable of producing three entirely different noise levels, the problem of their specific identification at any instant in any test situation becomes important. The emphasis here is on the documentation of these noise levels. The methods presented here permit the documentation of noise to identify specific problems which require solutions. Documented absence of noise guarantees the data, regardless of how unexplainable these data appear to be.
Author

N72-15849 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A SIMPLIFIED METHOD FOR MEASURING STATIC AND DYNAMIC DISPLACEMENT OF VIBRATING SYSTEMS
Paul T. JaQuay *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 17-27 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D C. 20390; $15.00/set

A noncontacting multiple probe system was developed for measuring static and dynamic displacements on acoustic test specimens. This system uses standard components, is easily calibrated, requires no recalibration when switching probes, uses standard coaxial cable and is insensitive to cable length. Design and performance of the system including some of the problems encountered with the circuitry are described.
Author

N72-15850 LTV Research Center Anaheim, Calif. Western Div.
INSTRUMENTATION FOR MEASUREMENT OF VIBRATORY MOTION AND MECHANICAL IMPEDANCE WITHIN ASSEMBLED AEROSPACE EQUIPMENT
Charles T. Morrow *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 29-32 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A ceramic piezoelectric vibration probe has been designed for the measurement of mechanical resonance inside aerospace equipment, without disassembly of such equipment, and through very small access holes. The mechanical impedance of the probe is very low to minimize errors from mechanical loading of the parts being measured. Mechanical impedance at the measurement points is obtained by observing the effects of known mechanical loads.
Author

N72-15851*# TRW Systems Group, Redondo Beach, Calif.
APPLICATIONS OF HOLOGRAPHY TO HIGH FREQUENCY VIBRATIONS AND TRANSIENT RESPONSE c16
R. Aprahamian and D. A. Evensen *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 33-44 refs (See N72-15847 06-32)
(Contract NAS1-8361)
(NASA-CR-125413) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Recent applications of holographic interferometry to vibration and transient response problems in applied dynamics are reported. Time average holography was applied to study high frequency transverse vibrations of a uniform cantilever beam. Modes from the 5th through the 34th were recorded on holograms; the corresponding frequencies ranged from 500 cps to 25,655 cps. Stored-beam holography was applied to study high frequency vibrations modes of a simply-supported rectangular plate. Over 100 modes were identified using this technique, at frequencies ranging from 162 cps to 20,000 cps. The transient response of an impulsively loaded cantilever beam was recorded using stored-beam holography and a high-speed motion picture camera. In all cases, the results show good agreement with the theory and demonstrate the capabilities of holography for vibration analysis.
Author

N72-15852*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW FREQUENCY PORTABLE VIBRATION MEASURING AND RECORDING SYSTEM
Sherman A. Clevenson, Dennis J. Martin, and Andrew C. Dibble *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 45-50 refs (See N72-15847 06-32)
(NASA-TM-X-67590; L-6952) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20K

The measurement and recording of the vibrations which affect passenger comfort in a transportation system present unique instrumentation requirements. Ideally, the equipment comprising the vibration system should be lightweight, portable, completely self-contained, battery-operated, inexpensive, and easy to operate. Described is a novel system consisting of vibration transducers, voltage controlled oscillators, and a stereo audio home-type tape recorder developed to meet the above requirements. The system performance and fidelity as well as the use of the device for measuring the ride environment of various transportation modes is described. Author

N72-15853 Naval Ship Research and Development Center, Annapolis, Md.
MEASUREMENT OF THE TOTAL STRUCTURAL MOBILITY MATRIX
James E. Smith *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 51-84 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A technique has been developed to measure the total structural mobility matrix describing a system of points on a structure. The method is based on the use of accelerometer response measurements alone. In this technique a calibrated vibration exciter is used which, under certain circumstances, produces, directly, accelerometer response measurements proportional to the unknown matrix of mobility properties. In general, however, these response measurements contain a systematic error which must be corrected by calculation. It is shown that for this calculation the properties of the vibration exciter exert a dominant influence on the amplification of propagated random experimental error. Author

N72-15854 Radiation, Inc., Melbourne, Fla.
DEVELOPMENT OF A SMALL TRANSMITTER FOR HIGH INTENSITY SHOCK ENVIRONMENT c14
E. L. Kirkley *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 85-91 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A requirement was established for the development of a small VHF transmitter that could withstand a 1000 g, 6-millisecond, halfsine shock pulse and be constructed with conventional electronic components. Described are the results of component and assembly level tests run during the development program, and the results of an over-test program to establish a failure threshold. After deciding on a conceptual circuit design and selecting the MIL-STD and off-the-self parts to make up the electronics, a search and evaluation effort was undergoing actual transmitter shock testing. A transmitter packaging concept was evolved based on interpretations of the shock spectra resulting from the design shock. Author

N72-15855 Bacharach Instrument Co., Mountain View, Calif. Johnson-Williams Div.
PREDICTABLE SHOCK PULSE BY MODIFIED FOURIER TRANSFORMS c19
Charles W. Young *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt 7 Dec. 1969 p 93-98 ref (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Methods of producing single pulse shapes on a vibration shaker by use of Fourier coefficients are demonstrated. The single sawtooth and half-sine are presented and the technique is described. The relationship of the analog computer and fast Fourier type of data system is discussed. An analog computer, the CDC 6400, and the fast Fourier transform analyzer TD-100 were used as generators and analyzers. A 5000 lb force shaker and amplifier produced the drive for forcing functions. Author

N72-15856*# Wyle Labs., Inc., Huntsville, Ala.
ON-LINE COMPUTER APPLICATIONS FOR THE APOLLO SHORT STACK COMBINED ENVIRONMENTS TEST PROGRAM c08
Daniel J. Bozich *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 99-113 refs (See N72-15847 06-32)
(Purchase Order M8M3XAS-482000)
(NASA-CR-125414) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 09B

The Apollo integrated shell structural test required an on-line data system for acquiring, monitoring, and displaying response data from 1600 measurement channels in real-time and for the quick-look analysis of these data in pseudo-real-time. Discussed were the techniques developed to acquire, monitor, process and display engineering information, which was used to both monitor the response of the several structures and to control the application of the resonant vibratory loads in real-time. This limited control feedback function of the data system played a major role in the overall success of the test program. Author

N72-15857 Boeing Co., Seattle, Wash.
DYNAMIC DATA ANALYSIS SYSTEM c11
Michael O. Michellich *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt 7 Dec. 1969 p 115-121 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A dynamic data analysis system is described that has been developed for test support and analysis of transient and random data. The system provides on line amplitude, frequency and time domain analyses for both local and remote operations. Analog inputs to the systems are transmitted via microwave from remote sites, via data lines directly from laboratory testing, and from local tape recorders for processing. The analog input signals are analyzed and results are transmitted back to the test or remote sites within a short period of time. The system can support eight laboratory tests, eight remote operations, and the local reduction operation simultaneously. Author

N72-15858 New Mexico Univ., Albuquerque. Dept. of Mechanical Engineering.
A DYNAMIC DATA COMPENSATION TECHNIQUE FOR SEISMIC TRANSDUCERS c09
G. L. Schulz and W. E. Baker *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 123-132 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A method for extending the usable frequency range of seismic transducers through the use of a digital data processing technique is presented. The method is based on the assumptions that a seismic transducer may be represented by a damped

single degree of freedom system and that the output of the transducer is proportional to the relative displacement between the seismic mass and the surface on which the transducer is mounted. The computational technique utilizes a new, efficient, and accurate method of numerical differentiation. The technique was checked using simulated accelerometer data rounded off to three significant figures, for several types of input acceleration pulses. In all cases significant increases in accuracy were obtained. Author

N72-15859 Massachusetts Inst. of Tech., Cambridge.
AIR DAMPED HIGH-g ACCELEROMETER AND WIDE BAND VELOCIMETER FOR SHOCK STUDY IN FREE MASS UNDER SEVERE AIR BLAST c14
Y. T. Li and S. Y. Lee *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 133-139 (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The design principle of a new type of motion sensor is presented which incorporates a seismic system with exceedingly low mass and spring rate to permit the use of air damping. With this principle, it is possible to realize a 10,000g accelerometer with .7 damping coefficient. A similar principle is applied in an air damped velocimeter to cover the range of velocity of a few hundred inches/per second and for frequencies up to 2,000 Hz. Another new development involves the use of feedback electronic integration to extend the low frequency range of the air damped velocimeter. The dynamic response of the two systems can be matched smoothly to extend the low frequency range to .1 Hz and lower, so that an overall bandwidth of 4 1/2 decades is achieved. Author

N72-15860 Shock and Vibration Information Center (Defense), Washington, D.C.
A SURVEY OF THE INFORMATION NEEDS OF INDUSTRY IN DESIGNING TO MEET NAVY SHIPBOARD SHOCK REQUIREMENTS
Henry C. Pusey *In its* The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 141-152 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The survey consists of a series of 13 conferences with shipbuilders, vendors, and design agents. The results of the survey are summarized. Recommendations are made on actions to be taken to alleviate the technical information problem in the ship shock area. Author

N72-15861 Ehrenpreis (David) Consulting Engineers, New York.
A CONVERSATIONAL TIME SHARING COMPUTER PROGRAM FOR DYNAMIC SHOCK ANALYSIS c08
Bruce A. Bott and Richard G. Gauthier (Gen. Dyn. Corp., Groton, Conn.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 153-164 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A computer program has been developed for the General Electric 605 time sharing computer system. The program will preform a dynamic shock analysis of structures containing up to 120 static and 48 dynamic degrees of freedom. Author

N72-15862 General Dynamics Corp., Groton, Conn. Electric Boat Div.
CRITERIA FOR MODE SELECTION IN THE DDAM PROCEDURE
Michael Pakstys, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 165-176 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Criteria for selection of the normal modes to be used in the detailed stress analysis portion of the Dynamic Design Analysis Method (DDAM) procedure utilized for shock analysis of Naval shipboard components and foundations are descussed. Presently specified criteria are reviewed and certain deficiencies are indicated. Two criteria which overcome these shortcomings - one based on response accelerations and the other based on response velocities - are discussed. Two example problems are presented to illustrate the results obtained by the use of the different criteria. The response velocity criterion is advocated since it is found to be more rigorous and efficient. Author

N72-15863 Gibbs and Cox, Inc., New York.
APPLICATION OF PERTURBATION TECHNIQUES TO THE NAVY'S DYNAMIC DESIGN ANALYSIS METHOD
James T. Higney *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 177-184 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Equations for the perturbation coefficients of an eigenvalue problem are applied to the current Dynamic Design Analysis Method (DDAM) for the shock analysis of shipboard equipment. A computer program has been developed which, on the basis of a perturbation analysis, projects the changes in effective static forces for assumed changes in each of the elements in the stiffness and mass matrices. Such projections aid in choosing design changes which reduce or eliminate overstresses in a given design. Applications of the perturbation techniques to four systems of varying complexity are shown. Author

N72-15864 Toledo Univ., Ohio.
AN ANALYSIS OF SPECTRUM DIP IN UNDERWATER SHOCK
R. J. Scavuzzo and D. D. Raftopoulos *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 185-195 refs (See N72-15847 06-32)
(Contract N00014-67-A-0555-00d1)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The objective of the analysis presented herein is to obtain an analytic solution of hull accelerations so that the spectrum dip phenomenon can be more fully understood. By considering only a single mass structure, the equation for the foundation acceleration can be expressed as the sum of four terms. The spectrum response of each of these terms can be studied. In this manner, it is found that the spectrum dip is caused only by the shape of the initial pulse in the velocity-time history of the shock motion. Author

N72-15865 General Electric Co., Groton, Conn.
DYNAMIC ANALYSIS OF SUBMERGED SHIP STRUCTURE AND EQUIPMENT
D. B. Ehrenpreis *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 197-205 refs (See N72-15847 06-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A new method is recommended for analysis of stresses, margins of safety and deflections of ship equipment, and portions of ship structure submerged in water and subjected to underwater explosion shock pressure loads. The minesweeper kort nozzle is presented as an illustrative example of the recommended method. The nozzle structure is subjected to both direct pressure impulse loading, and velocity shock input caused by ship structure motion. Author

N72-15866 Naval Construction Research Establishment, Dunfermline (Scotland).

DYNAMIC BEHAVIOR OF PARTIALLY CONSTRAINED SHIP GRILLAGES

C. S. Smith and D. Faulkner *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 207-223 refs (See N72-15847 06-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 203905 $15.00/set

A number of alternative methods of estimating natural frequencies and mode shapes for ship grillages are reviewed and developed. Particular reference is made to the inclusion of axial load effects and the treatment of elastically constrained boundaries. The advantages and limitations of each method as a practical design tool are assessed and illustrative solutions are included for a typical deck structure. Author

N72-15867 Naval Ship Research and Development Center, Washington, D.C.

AN ENVIRONMENTAL VIBRATION RECORDER c14

R. E. Schauer and W. P. Foster *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 225-232 refs (See N72-15847 06-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

An environmental vibration recorder was developed to obtain vibration data over a long period of time while a ship operates in various sea-states. Described is a second generation instrument which reduces analysis time by recording only the peak level of vibration data at selected frequencies. Each transducer is sampled for the maximum value for five minutes, and the output is recorded in binary code on paper tape. Transducer number, time ships heading, sea-state, sea angle of attack, shaft RPM, and wind velocity are recorded with the vibration data. Author

N72-15868 Barry Controls, Inc., Watertown, Mass.

THE 2K SYSTEM APPROACH FOR VIBRATION AND SHOCK PROTECTION FOR SHIPBOARD EQUIPMENTS

C. M. Salerno *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 233-241 refs (See N72-15847 06-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Today's quest for shipboard electronic equipment to provide maximum efficiency, maintain high reliability and yet endure the vibration and shock environments aboard ship is a subject of much concern. The application of conventional shock and vibration mountings help to alleviate some of the harmful dynamic effects but at the same time exhibit some undesirable characteristics. An isolation system is presented utilizing a two-stage approach which exhibits a high degree of vibration and shock isolation and also alleviates many of the undesirable characteristics of the conventional mountings. Author

N72-15869 Naval Ship Research and Development Center, Washington, D.C.

PORTABLE INSTRUMENTS FOR USE IN CONNECTION WITH SHIPBOARD VIBRATIONS CODES c14

R. K. Brown and A. Hagen *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 7 Dec. 1969 p 243-247 refs (See N72-15847 06-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A code has been developed to establish standard procedures for obtaining and evaluating data on hull vibrations on naval and merchant ships. Portable instruments have been developed for use in obtaining the data described in the code. These instruments have been integrated into a portable vibration measurement kit which can be used on any ship. The kit is described and a detailed description of each component and its interconnection in the resulting system is given. Author

N72-15870 National Lending Library for Science and Technology, Boston Spa (England).

EQUIPMENT FOR INVESTIGATING THE RHEOLOGICAL CHARACTERISTICS OF MATERIALS

Ya. M. Okhrimenko, O. M. Smirnov, V. P. Balakin, and L. V. Surmach 1971 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 7, 1971 p 110-113

(NLL-M-21167-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A method is examined for investigating rheological characteristics, in particular the sensitivity coefficient of the resistance to deformation to changes in the relative rate of deformation (the coefficient m). Equipment is described, enabling experiments to be performed for determining the coefficient m in different temperature-rate schedules. Author

N72-15871 National Lending Library for Science and Technology, Boston Spa (England).

CRITERIA OF EQUIVALENCE UNDER CONDITIONS OF CREEP DURING COMPLEX STRESSED STATE

A. V. Lebedev 19 Nov. 1971 7 p refs Transl. into ENGLISH from Probl. Prochnosti (USSR), no. 4, 1970 p 45-48 In ENGLISH and RUSSIAN

(NLL-Trans-746-922-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The criteria of equivalence for construction elements under conditions of static loading were established according to the given tolerance on the residual deformation (creep) or duration (prolonged stability). The generalized criterion for the prolonged stability of a series of heat resistant steels and alloys is described. Theoretical and experimental substantiation of methods for determining the equivalent stress of structural members are presented. Author

N72-15872*# Cornell Univ., Ithaca, N.Y.

A FINITE ELEMENT PROCEDURE FOR NONLINEAR PREBUCKLING AND INITIAL POSTBUCKLING ANALYSIS

S.-T. Mau and R. H. Gallagher Washington NASA Jan. 1972 56 p refs

(Grant NGR-33-010-070)

(NASA-CR-1936) Avail: NTIS CSCL 20K

A procedure cast in a form appropriate to the finite element method is presented for geometrically nonlinear prebuckling and postbuckling structural analysis, including the identification of snap-through type of buckling. The principal features of this procedure are the use of direct iteration for solution of the nonlinear algebraic equations in the prebuckling range, an interpolation scheme for determination of the initial bifurcation point, a perturbation method in definition of the load-displacement behavior through the postbuckling regime, and extrapolation in determination of the limit point for snap-through buckling. Three numerical examples are presented in illustration of the procedure and in comparison with alternative approaches. Author

N72-15873*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

ANALYSIS OF TRANSIENT, LINEAR WAVE PROPAGATION IN SHELLS BY THE FINITE DIFFERENCE METHOD

Thomas L. Geers and Lawrence H. Sobel Washington NASA Dec. 1971 191 p refs

(Contract NAS1-9111)

(NASA-CR-1885) Avail: NTIS CSCL 20K

The applicability of the finite difference method to propagation problems in shells, and the response of a cylindrical shell with cutouts to both longitudinal and radial transient excitations are investigated. It is found that the only inherent limitation of the finite difference method is its inability to

reproduce accurately response discontinuities. The short wave length limitations of thin shell theory create significant convergence difficulties may often be overcome through proper selection of finite difference mesh dimensions and temporal or spatial smoothing of the excitation. Cutouts produce moderate changes in early and intermediate time response of a cylindrical shell to axisymmetric pulse loads applied at one end. The cutouts may facilitate the undesirable late-time transfer of load-injected extensional energy into nonaxisymmetric flexural response. Author

N72-15874*# Garrett Corp., Los Angeles, Calif.
LOW CYCLE FATIGUE TESTING MACHINE Patent Application
Christor Demogenes and Connie E. Richard, inventors (to NASA) Filed 4 Aug. 1970 11 p
(Contract NAS1-5002)
(NASA-Case-LAR-10270-1; US-Patent-Appl-SN-60881) Avail: NTIS CSCL 20K

A low-cycle, fatigue tester which simulates cyclic thermal loading by the application of cyclic mechanical stresses and deformations is described. The specimen is heated to the critical temperature of the structure under consideration, and then deformed cyclically by the two interconnected, opposing, convex jaws of a mandrel driven reciprocally by an oscillating ram. The cyclic wrapping of the specimen around the opposing jaws of the mandrel mechanically induces alternating compression and tension stresses in the surfaces of the specimen which simulate the thermal stresses that would be caused by a temperature gradient through the depth of the structure under consideration. The stress level is controlled by the radius of the mandrel. The frequency of the oscillation is representative of the frequency of the thermal cycle effecting the structure under consideration. NASA

N72-15875# Brown Univ., Providence, R.I.
EXTREMUM PRINCIPLES FOR A CLASS OF DYNAMIC RIGID-PLASTIC PROBLEMS
John B. Martin Aug. 1971 53 p refs
(Contract N00014-67-A-0191-0003; Task Order NR-064-424)
(AD-730010; TR-14) Avail: NTIS CSCL 20/11

A number of extremum principles are developed for the acceleration fields associated with rigid-plastic dynamic loading problems. Major emphasis is given to global and local principles for mode solutions (where the spatial variables may be separated from time). The extremum principles are developed by first considering a simple model and then proving for structure of any configuration. The discussion is limited to problems in which the displacements are small. Author (GRA)

N72-15876# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE PENETRATION OF RAIN THROUGH AN ANNULAR AIR-CURTAIN DOME
R. Lake and B. Etkin Aug. 1971 23 p refs
(UTIAS-163) Avail: NTIS

Investigations have been carried out on a 12 in. diameter model as to the energetic feasibility of protecting a region of space from rainfall by means of an annular jet enclosure. The results of the experiments indicate power requirements, in the absence of side wind, of .05-0.1 H.P./sq. ft. dry area. A theoretical analysis indicates that the power per unit area approaches a constant for 'large' diameters, but a numerical value cannot yet be assigned to 'large'. Author

N72-15877# Sandia Labs., Albuquerque, N.Mex.
METHODOLOGY FOR ANALYSIS OF FATIGUE IN SOLDER JOINTS
L. J. Merrell Aug. 1971 30 p refs Sponsored by AEC
(SC-RR-710326) Avail: NTIS

An attempt was made to establish criteria by which the capacity of soldered joint designs to withstand cyclic loading can be judged. From thermal cycling experiments it was learned that a safe number of cycles, at any strain values (or several values), may be predicted from knowledge of the geometry and properties of the materials in the solder joint and the temperature cycle expected. Author

N72-15878# McElroy (Ralph) Co., Austin, Tex.
HISTORY OF THE ACOUSTIC EMISSION METHOD: A NEW TOOL FOR NDT
Eiji Isono [1971] 32 p refs Transl. into ENGLISH from Hihakai Kensa (Japan), no. 11, 1970 p 579-598 Sponsored by AEC Prepared for Dow Chem. Co., Golden, Colo.
(RFP-Trans-79) Avail: NTIS

A history of the acoustic emission method is presented. Use of the method for monitoring pressure tests for a missile fuel tank or a nuclear pressure vessel, studying destructive mechanisms (plastic deformation, brittle fracture, fatigue, corrosion stress cracks, etc.), and studying or monitoring weld cracks are also discussed. NSA

N72-15879# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugzeugbau.
APPLICATION OF THE RAYLEIGH-RITZ METHOD WITH MESHWISE INTERPOLATION FOR CALCULATING THE BUCKLING LOADS OF SHALLOW SANDWICH SHELLS WITH PARALLEL EDGES
K. Rohwer 1971 46 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-30) Avail: NTIS; DFVLR Porz: 9,50 DM

The buckling loads of shallow orthotropic sandwich shells with parallel edges are investigated. The potential energy, established for rectangular coordinates is translated to skew parallel coordinates, so the boundary conditions may be described more easily. The buckling loads are determined as eigenvalues from a Ritz set up with mesh Hermite interpolation polynomials. Results of computed examples, such as the sandwich panels for sweptback wings, are presented. Author (ESRO)

N72-15880# Royal Aircraft Establishment, Farnborough (England).
CUMULATIVE DAMAGE IN FATIGUE WITH PARTICULAR REFERENCE TO THE EFFECTS OF RESIDUAL STRESSES
P. R. Edwards London Aeron. Res. Council 1971 133 p refs Supersedes RAE-TR-69237; ARC-32168
(ARC-CP-1185; RAE-TR-69237; ARC-32168) Avail: NTIS; HMSO

Factors affecting the accuracy of Palmgren-Miner's rule are discussed. An investigation is also described of the cumulative damage behaviour of DTD 5014 aluminum alloy lug specimens using random loading. It is concluded that the deviations from Miner's rule observed in the investigation can be ascribed mainly to the action of residual stresses associated with yielding at the point of fatigue initiation. An attempt is made to quantify this effect. Author (ESRO)

N72-15881# North Carolina State Univ., Raleigh. Center for Acoustical Studies.
A FORTRAN PROGRAM FOR CALCULATING THE FREQUENCIES AND MODE SHAPES OF A GUIDED CLAMPED, GUIDED PINNED, CLAMPED, AND PINNED SPHERICAL SHELL
George Georgopoulos and Larry H Royster Jan. 1972 45 p refs
(Contract Nonr-486(11); NR Proj. 185-551)
(AD-731062; TR-22) Avail: NTIS CSCL 20/11

The report describes a FORTRAN IV program capable of obtaining a finite element numerical solution to the free axisymmetric vibrations of a spherical shell with linearly varying thickness, and, guided clamped, guided pinned, clamped, and pinned boundary conditions. Author

N72-15882# North Carolina State Univ., Raleigh. Dept. of Mathematics.
CONTACT (MIXED) PROBLEMS OF THE THEORY OF ELASTICITY
B. L. Abramyan 30 Sep. 1971 47 p refs Transl. into ENGLISH from Inzh. Zh., Mekh. Tverd. Tela (Moscow), v. 4, 1969
(Grant AF-AFOSR-1779-69; AF Proj. 9749)
(AD-731098; AFOSR-71-2646TR; PSR-99/8; Rept-61102F; Rept-681304) Avail: NTIS CSCL 20/11

The report is an English translation of a Russian bibliographic review of recent publications (1964-69) on contact problems. It takes no account of thermoelastic problems, the theory of bending of plates, or stress distributions in regions containing cracks; neither does it deal with problems whose approximate solutions have been obtained by application of variational techniques. The author does provide an extensive review outlining the various types of problems considered in the referenced papers and the methods employed by their authors.
Author (GRA)

N72-15883# Brown Univ., Providence, R.I. Div. of Engineering.
ON THE APPLICATION OF THE BOUNDING THEOREMS OF PLASTICITY TO IMPULSIVELY LOADED STRUCTURES
John B. Martin Jul. 1971 42 p refs Presented at the Symp. on the Dyn. Response of Struct., Stanford, Calif., 28-29 Jun. 1971
(Contract N00014-67-A-0191-0003)
(AD-730009; TR-13) Avail: NTIS CSCL 20/11

A review of recent progress in the development of displacement bounding techniques for dynamically loaded structures is presented. This recent progress is based on a clearer formulation of the bounding theorems of time independent plasticity, and extends the bounding technique to cover structures in which displacements are large. Author (GRA)

N72-15884# California Univ., San Diego. Dept. of Aerospace and Mechanical Engineering Sciences.
QUADRATIC EIGENVALUE PROBLEMS FROM A NONLINEAR STRUCTURAL ANALYSIS
W. Nachbar and J. M. Jong Jun. 1971 39 p refs
(Grant AF-AFOSR-2062-71; AF Proj. 9782-01)
(AD-731115; TR-2; AFOSR-71-1967TR; Rept-61102F; Rept-681307) Avail: NTIS CSCL 20/11

In application of the previously developed modified structure method to the study of the nonlinear behavior of continuous elastic structures, including bifurcation and snap-through, one is generally led to an eigenvalue problem in which the eigenparameter appears quadratically in the coefficients of a linear differential equation. In the present study, the elementary example of a fixed-free column loaded both axially and laterally is considered as a continuum problem, an approach possible within the scope of the modified structure method. Earlier studies of this problem in finite element formulation showed non-existence of an eigenvalue for very slender columns. The present paper investigates the question of existence of a positive eigenvalue in a hierarchy of linearized quadratic eigenvalue problems which result from the retention of higher-order terms in the expansion of the potential energy functional. Nonexistence of eigenvalues for columns of sufficiently high slenderness ratio rho is shown, and the Rayleigh quotient method is used to bound the eigenvalue and give an approximation to the critical value of rho. Author (GRA)

N72-15885# Biot (Maurice A.), Brussels (Belgium).
NEW THEORY OF MULTILAYERED PLATES Final Scientifical Report, 15 Dec. 1968 - 15 Dec. 1970
Maurice A. Biot (Roy. Acad. of Belgium) 15 Dec. 1970 18 p refs
(Contract F61052-69-C-0030; AF Proj. 9782-01)
(AD-729945; AFOSR-71-2360TR) Avail: NTIS CSCL 13/13

The work presents a new approach to the dynamics of multilayered plates with anisotropy and viscoelasticity. Some of the layers may be constituted by thinly laminated materials giving rise to stress-couples. The theory takes into account the fundamental skin effect of solid mechanics, and the cross-sectional distortion of the layers. While much simpler than the theory of elasticity, it provides a considerable refinement of classical plate theories. Plane strain solutions are developed for simply supported and built-in plates. The damping is derived from approximate expressions which bring out the contribution of individual layers to the overall damping. Application to plates with one, two and three layers are discussed. For transverse isotropic plates, three-dimensional solutions are immediately derived by superposition of plane strain solutions. This is applied to multilayered plates with rectangular, triangular and circular plan form. Author (GRA)

N72-15886# Army Materials and Mechanics Research Center, Watertown, Mass. Mechanics of Materials Div.
UTILIZATION OF THE BEND TEST FOR DETERMINING STRESS-STRAIN CURVES
John Campo Jul. 1971 28 p refs
(DA Proj. 1T0-62105-A-328)
(AD-731203; AMMRC-TR-71-13; AMCMS-Code-502E.11.294) Avail: NTIS CSCL 14/2

Experimental verification of the utilization of the bend test for determining stress-strain curves for tension and compression is presented. Stress-strain curves are determined from independently performed tension, compression, and bend tests of AISI 4340 steel specimens (heat treated to three nominal yield strength levels - 125,000, 175,000, and 225,000 psi, respectively, at 0.2% offset) and compared. Fair agreement is found to exist among the curves up to the 2% strain limit of each test.
Author (GRA)

N72-15887# Watervliet Arsenal, N.Y.
THE MICROSTRUCTURE FORMULATION OF THE EFFECTIVE STIFFNESS THEORY FOR LAMINATED MEDIA
Charles R. Thomas Aug. 1971 59 p refs
(DA Proj. 1F0-61102-A-35-D)
(AD-731181; WVT-7139; AMCMS-Code-501B.11.35D00.01) Avail: NTIS CSCL 20/11

The derivation of the effective stiffness or microstructure theory for a laminated medium is developed and the relationship of the resultant theory to the effective modulus or transversely isotropic elastic theory is shown. Approximations involved in the original assumptions are carefully considered and the applicable range of both theories is discussed. Author (GRA)

N72-15888# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION ON THE THEORY OF PLATES AND FILM (SELECTED ARTICLES)
F. S. Isanbaeva, A. V. Sachenkov, Yu. G. Konoplev, L. G. Agebosov, and G. M. Salnikov 30 Aug. 1971 99 p refs Transl. into ENGLISH from the book "Issledovaniya po Teorii Plastin i Obolochek" USSR 1965 p 3-17, 35-42, 81-90, 189-195, 204-211, 237-243, 294-299
(FTD Proj. 6010606)
(AD-731386; FTD-HC-23-152-71) Avail: NTIS CSCL 20/11

Contents: Large deflections of plates with freely moving edges; Stability of annular plates and of mildly-sloping truncated spherical shells under shear; A study of large deflections of circular plates subject to local loads; Applications of the K. Z. Galimov method to problems of shell dynamics; Problems of dynamic stability of a thin conical shell; Stability of plates and shells in transient creep; and Stability of a rectangular bimetallic plate in nonuniform heating. GRA

N72-15889# General Technology Corp., Lawrenceville, N.J.
ELASTO-PLASTIC DYNAMICAL BUCKLING OF CIRCULAR THIN SHELLS UNDER AXIAL IMPACT
A. C. Eringen and Tsun-yung Chang Dec. 1970 43 p refs
(Contract DAAA21-71-C-0075)

(AD-731297; TR-13-2) Avail: NTIS CSCL 20/11

Dynamical motions of a circular cylindrical thin shell simply supported at one end and free to expand in the circumferential and radial direction at the other end are studied under the condition of axial impact. The axial compressions applied exceed the static buckling loads. As the initial conditions, the displacement field and velocity field of circumferential and radial directions are assumed to vanish except the initial axial velocity field of the cylinder. In order to account for the effect of plasticity (without unloading) on buckling, the second order elastic stress-strain relations are used with simplifications that the effect of the initial axial load on the bending moment is constant. The displacement and stress fields are obtained by solving the dynamical equations of motions under the boundary and initial conditions. The shortening of the shell at any time and the classical static buckling, including the plastic effect, are determined. Author (GRA)

N72-15890# General Technology Corp., Lawrenceville, N.J.
A FINITE DEFLECTION THEORY FOR CYLINDRICAL SHELLS
A. C. Eringen Dec. 1970 19 p refs
(Contract DAAA21-71-C-0075)
(AD-731296; TR-13-1) Avail: NTIS CSCL 20/11

A finite deformation theory is formulated for cylindrical shells having nonlinear stress-strain characteristics. Equations of dynamical motions are obtained, and boundary and initial conditions are presented. Author (GRA)

N72-15795# Standard Telephone Cables, Cockfosters (England).
ENVIRONMENTAL SPECIFICATIONS
E. S. Ward *In* Soc. of Environ. Engr. Environ. Eng. 1970 9 p (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

N72-15797# British Aircraft Corp., Weybridge (England). Acoustics Lab.
ACOUSTIC TESTING, AIRCRAFT STRUCTURES
John A. Hay *In* Soc. of Environ. Engr. Environ. Eng. 1970 27 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

N72-15798# Northern Technological Inst. Haren (Netherlands). Vibration and Stress Analysis Dept.
SOME SPECIAL PROBLEMS IN VIBRATION AND SHOCK ISOLATION
A. J. Francken *In* Soc. of Environ. Engr. Environ. Eng. 1970 22 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

N72-15799# Institutet foer Miljoeteknik, Stockholm (Sweden).
SHOCK AND BUMP TESTING
K. Spaang *In* Soc. of Environ. Engr. Environ. Eng. 1970 12 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

N72-15802# Brueel and Kjaer, Naerum (Denmark).
SOME ASPECTS OF VIBRATION TESTING
Jens T. Broch *In* Soc. of Environ. Engr. Environ. Eng. 1970 27 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

N72-15803# Institute TNO for Mechanical Constructions, Delft (Netherlands).
ANALYSIS OF RESPONSE OF STRUCTURES TO VIBRATION ENVIRONMENT
H. H. Hart *In* Soc. of Environ. Engr. Environ. Eng. 1970 21 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

N72-15805# Atomic Weapons Research Establishment, Aldermaston (England).
ACCELERATED VIBRATION TESTING
J. A. L. Yarnold *In* Soc. of Environ. Engr. Environ. Eng. 1970 16 p refs (See N72-15791 06-31)
Avail: NTIS HC $6.00/MF $0.95

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N72-15891*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: HEAT TRANSFER RATE MEASUREMENTS ON CONVAIR BOOSTER (B-15B-2) AT NOMINAL MACH NUMBER OF 8
J. D. Warmbrod, W. R. Martindale (ARO, Inc.), and R. K. Matthews (ARO, Inc.) Nov. 1971 141 p
(Contract NAS8-4016)
(NASA-CR-119987; DMS-DR-1177-Vol-2) Avail: NTIS CSCL 20M

Plotted and tabulated data on heat transfer from a thin-skin thermocouple are presented. The data is representative of the reentry event of the booster alone configuration. The data were generated during wind tunnel tests of the B-15B-2 delta wing booster at Mach 8. Thermocouple measurements are reduced to heat transfer coefficient ratio and the data are presented as plotted variations versus longitudinal, lateral, and vertical local model positions. Author

N72-15892*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL DESIGN STUDY OF AN AIR-COOLED PLUG-NOZZLE SYSTEM FOR A SUPERSONIC CRUISE AIRCRAFT
John S. Clark and Arthur Lieberman Washington Jan. 1972 50 p refs
(NASA-TM-X-2475; E-6348) Avail: NTIS CSCL 20M

A heat-transfer design analysis has been made of an air-cooled plug-nozzle system for a supersonic-cruise aircraft engine. The proposed 10deg half-angle conical plug is sting supported from the turbine frame. Plug cooling is accomplished by convection and film cooling. The flight profile studied includes maximum afterburning from takeoff to Mach 2.7 and supersonic cruise at Mach 2.7 with a low afterburner setting. The calculations indicate that, for maximum afterburning, about 2 percent of the engine primary flow, removed after the second stage of the nine-stage compressor, will adequately cool the plug and sting support. Ram air may be used for cooling during supersonic-cruise operations, however. Therefore, the cycle efficiency penalty paid for air cooling the plug and sting support should be low. Author

N72-15893*# North American Rockwell Corp., Downey, Calif.
SELF-CYCLING FLUID HEATER Patent Application
Walter K. Moen, inventor (to NASA) Filed 6 Nov. 1970 20 p
(Contract NAS9-150)
(NASA-Case-MSC-15567-1; US-Patent-Appl-SN-87551) Avail: NTIS CSCL 20M

The specification discloses a self-cycling fluid heater, including a high temperature upstream preheater for elevating the stream temperature and a high intensity jet arc heater. This heats the preheated fluid stream to ultrahigh reaction temperatures and discharges it into an electrical resistance tubular heater with variations in wall thickness at intervals along its length. This discharge controls the temperature of the fluid passing through

the heater for desired time intervals in order to provide the chemical reactions desired. NASA

N72-15894*# University of Southern Calif., Los Angeles. Western Research Application Center.
FIREPROOFING AND SAFETY SYMPOSIUM PROCEEDINGS
27 May 1971 154 p refs Conf. held at Los Angeles, 27 May 1971 Sponsored by NASA
(NASA-CR-125412) Avail: NTIS CSCL 13L

The proceedings of a conference on fire prevention and fireproofing of construction materials are presented. Discussions were primarily concerned with newly developed, nonflammable materials and the methods for incorporating the materials into aerospace vehicles and buildings. Examples of proper and improper application of fireproof materials are described. For individual titles, see N72-15895 through N72-15901.

N72-15895*# University of Southern Calif., Los Angeles. Dept. of Mechanical Engineering.
INTRODUCTION TO PROGRAM SUBJECT: FIREPROOFING
Melvin Gerstein *In its* Fireproofing and Safety Symp. Proc. 27 May 1971 p 19-32 refs (See N72-15894 06-33)
Avail: NTIS CSCL 13L

Various processes for fireproofing materials are discussed. The conditions under which fireproofing measures may be adequate are compared with conditions under which the measures may be inadequate. The mechanisms for flame propagation and conditions required for ignition and burning are described. Author

N72-15896*# Los Angeles City Fire Dept., Calif.
UTILIZATION OF AVAILABLE SKILLS AND MATERIALS IN FIRE PREVENTION
Harry W. Martin *In* Univ. of S. Calif. Fireproofing and Safety Symp. Proc. 27 May 1971 p 33-40 (See N72-15894 06-33)
Avail: NTIS CSCL 13K

Procedures for installing fire protection systems in large buildings are discussed. Factors considered in the safety management are: (1) distribution of water supply, (2) design and location of exits, (3) emergency power system, and (4) maintenance procedures. Author

N72-15897*# Fireman's Fund Insurance Co., San Francisco, Calif.
HOW TO REDUCE YOUR FIRE INSURANCE RATES
Myron DuBain *In* Univ. of S. Calif. Fireproofing and Safety Symp. Proc. 27 May 1971 p 41-53 refs (See N72-15894 06-33)
Avail: NTIS CSCL 13L

Construction procedures and utilization of materials to reduce the cost of insuring large buildings against losses from fire are discussed. Examples of good and bad techniques in building construction and fire safety management are provided. The inadequacies of building codes and the hazards resulting from improper construction are examined. Author

N72-15898*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NEW FIRE RETARDANT FOAMS AND INTUMESCENTS c18
John A. Parker *In* Univ. of S. Calif. Fireproofing and Safety Symp. Proc. 27 May 1972 p 55-108 refs (See N72-15894 06-33)
Avail: NTIS CSCL 11D

The development of fire retardant foams and intumescent paints for protection of commercial aircraft passengers in the event of fire is discussed. Recommended materials and methods for evaluating the effectiveness of the materials are presented. Typical problems resulting from aircraft fires and the basic protective mechanisms to cope with these problems are examined. Author

N72-15899*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
OTHER NASA-DEVELOPED MATERIALS AND SOME INDUSTRIAL APPLICATIONS c18
Matthew I. Radnofsky *In* Univ. of S. Calif. Fireproofing and Safety Symp. Proc. 27 May 1971 p 109-129 (See N72-15894 06-33)
Avail: NTIS CSCL 11D

The characteristics and applications of various materials for fireproofing aerospace vehicles are discussed. Materials described are: (1) fibrous materials, (2) nonflammable paper and paperboard, (3) elastomers, (4) foams, and (5) plastics. The suitability of the various materials for specific applications are investigated. Author

N72-15900*# Thermal Systems, Inc., St. Louis, Mo.
FIRE RETARDANCY USING APPLIED MATERIALS c18
Rubin Feldman *In* Univ. of S. Calif. Fireproofing and Safety Symp. Proc. 27 May 1971 p 131-162 refs (See N72-15894 06-33)
Avail: NTIS CSCL 13L

An example of advanced technology transfer from the Little Joe, Surveyor, Comsat, re-entry and Apollo age to everyday fire protection needs is presented. Utilizing the principle of sublimation cooling for thermostatic temperature control, the material meets a wide range of fire retardancy and heat transmission control requirements. Properties vary from flexible tape for conduits and electrical cables to rigid coatings for column protection, with a broad spectrum of sublimation temperatures available. The material can be applied in the field or in the factory, utilizing mass production techniques, yielding a product that is reliable, effective, widely available and low in cost. Author

N72-15901*# Koppers Co., Inc., Pittsburgh, Pa.
FIRE RETARDANCY WITH STRUCTURAL MATERIALS c18
Richard E. Gardner *In* Univ. of S. Calif. Fireproofing and Safety Symp. Proc. 27 May 1971 p 163-172 (See N72-15894 06-33)
Avail: NTIS CSCL 11D

Impregnating wood with chemicals to reduce or prevent combustion is discussed. Basic types of materials for fireproofing purposes and methods of applications are described. It is concluded that effective fireproofing materials have been developed and their application to wooden structures represents acceptable safety management procedures. Author

N72-15902*# Bell Aerospace Co., Buffalo, N.Y.
FEASIBILITY STUDY FOR AUTOMATIC REDUCTION OF PHASE CHANGE IMAGERY
G. O. Nossaman [1971] 102 p refs
(Contract NAS1-10598)
(NASA-CR-112001) Avail: NTIS CSCL 20M

The feasibility of automatically reducing a form of pictorial aerodynamic heating data is discussed. The imagery, depicting the melting history of a thin coat of fusible temperature indicator painted on an aerodynamically heated model, was previously reduced by manual methods. Careful examination of various lighting theories and approaches led to an experimentally verified illumination concept capable of yielding high-quality imagery. Both digital and video image processing techniques were applied to reduction of the data, and it was demonstrated that either method can be used to develop superimposed contours. Mathematical techniques were developed to find the model-to-image and the inverse image-to-model transformation using six conjugate points, and methods were developed using these transformations to determine heating rates on the model surface. A video system was designed which is able to reduce the imagery rapidly, economically and accurately. Costs for this

system were estimated. A study plan was outlined whereby the mathematical transformation techniques developed to produce model coordinate heating data could be applied to operational software, and methods were discussed and costs estimated for obtaining the digital information necessary for this software. Author

N72-15903*# Battelle Memorial Inst., Columbus, Ohio.
EVALUATION OF NONMETALLIC THERMAL PROTECTION MATERIALS FOR THE MANNED SPACE SHUTTLE. VOLUME 1, TASK 1: ASSESSMENT OF TECHNICAL RISKS ASSOCIATED WITH UTILIZATION OF NONMETALLIC THERMAL PROTECTION SYSTEM Final Report
W. H. Wilkinson, F. P. Kirkhart, C. W. Kistler, W. H. Duckworth, E. W. Ungar, and E. L. Foster 15 Oct. 1970 119 p refs
(Contract NAS9-10853)
(NASA-CR-125402) Avail: NTIS CSCL 22B

Technical problems of design and flight qualification of the proposed classes of surface insulation materials and leading edge materials were reviewed. A screening test plan, a preliminary design data test plan and a design data test plan were outlined. This program defined the apparent critical differences between the surface insulators and the leading edge materials, structuring specialized screening test plans for each of these two classes of materials. Unique testing techniques were shown to be important in evaluating the structural interaction aspects of the surface insulators and a separate task was defined to validate the test plan. In addition, a compilation was made of available information on proposed material (including metallic TPS), previous shuttle programs, pertinent test procedures, and other national programs of merit. This material was collected and summarized in an informally structured workbook. Author

N72-15904*# Purdue Research Foundation, Lafayette, Ind. Heat Transfer Lab.
IMPROVED FLUID DYNAMICS SIMILARITY, ANALYSIS AND VERIFICATION. PART 5: ANALYTICAL AND EXPERIMENTAL STUDIES OF THERMAL STRATIFICATION PHENOMENA Final Report, 29 Jun. 1965 - 28 Jun. 1968
E. R. F. Winter, R. J. Schoenhals, R. I. Haug, T. L. Libby, R. N. Nelson, and W. H. Stevenson Oct. 1968 105 p refs
(Contract NAS8-20222)
(NASA-CR-121037) Avail: NTIS CSCL 20M

The stratification behavior of a contained fluid subjected to transient free convection heat transfer was studied. A rectangular vessel was employed with heat transfer from two opposite walls of the vessel to the fluid. The wall temperature was increased suddenly to initiate the process and was then maintained constant throughout the transient stratification period. Thermocouples were positioned on a post at the center of the vessel. They were adjusted so that temperatures could be measured at the fluid surface and at specific depths beneath the surface. The predicted values of the surface temperature and the stratified layer thickness were found to agree reasonably well with the experimental measurements. The experiments also provided information on the transient centerline temperature distribution and the transient flow distribution. Author

N72-15905# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
A PHOTOGRAPHIC STUDY OF SUBCOOLED FLOW BOILING AND THE BOILING CRISIS IN FREON-113 Ph.D. Thesis
Roger Joseph Mattson Jan. 1972 124 p refs
(Grant NSF GK-1889)
(UMICH-01357-22-T) Avail: NTIS

An experimental investigation of the causal mechanisms in the subcooled flow boiling crisis is reported. Freon-113 was used at moderate pressures of 100 to 350 psia to model water at high pressures of 800 to 2500 psia. This range includes the 2250 psia operating pressure of pressurized water nuclear reactors. For this photographic study the horizontal, rectangular flow channel with a narrow ribbon heater on the bottom surface was designed to minimize optical distortions and to provide an unobstructed view of the two-phase flow patterns. The results were high resolution, high speed, still and motion pictures of subcooled flow boiling before, during, and after departure from nucleate boiling (DNB) for a range of pressures, subcoolings, and mass flow rates. The following measurements were made from the photographs: bubble size, bubble size distribution, bubble boundary layer thickness, and the post-DNB vapor layer thickness. It was concluded that the two-phase flow regime in high pressure subcooled boiling is bubbly in which small vapor bubbles from a flowing boundary layer along the heated surface. At DNB there are no abrupt changes in bubble size, bubble population density, bubble flow trajectory, bubble boundary layer thickness, or bubble boundary layer slope. F.O.S.

N72-15906# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
ON THE EFFECTS OF HEAT TRANSFER UPON COLLAPSING BUBBLES
Terry Mitchell and Frederick G. Hammitt Jan. 1972 38 p refs
(Grant NSF GK-13081)
(UMICH-03371-15-T) Avail: NTIS

The effects upon spherically-symmetric bubble collapse of the various thermodynamic parameters including interfacial non-equilibrium boundary effects are examined numerically, for the case of cavitation or highly subcooled boiling bubbles. Pressures in the surrounding liquid as a function of time and distance are computed. It is shown that the value selected for the evaporation coefficient has a very strong influence on collapse pressures and velocities. The thermal diffusivity of the bubble contents is also significant but somewhat less important. The effect of non-equilibrium temperature or pressure discontinuities at the interface were found negligible for the cases studied. Author

N72-15907*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL CONVECTION AT INFINITE PRANDTL NUMBER
J. R. Herring Oct. 1969 36 p refs
(NASA-TM-X-65788; X641-69-440) Avail: NTIS CSCL 20M

Numerical solutions are developed for the full scaled three dimensional thermal convection problem, at infinite Prandtl number, and for rigid boundaries. The procedure is designed to give an approximate account of horizontally homogeneous and isotropic flow situations. Results, which included a maximum of 36 horizontal wave number vectors and 20 vertical wave numbers, appear to adequately describe the flow fill up to R = 100,000; beyond this R the results appear to show horizontal wave number truncation error. This error seems to affect the boundary slope of the mean temperature field more than other mean quantities. Despite some numerical uncertainities, certain of the qualitative features of the flow fill are predicted with reasonable confidence. Author

N72-15908*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REENTRY THERMAL PROTECTION FROM PIONEER F RTG INSULATION MATERIAL
John W. Vorreiter Jan. 1972 23 p ref
(NASA-TM-X-62100) Avail: NTIS CSCL 20M

Ablation tests were performed on the insulation material used in the Pioneer F radioisotope thermoelectric generator (RTG) in the Ames Arc-Heated Planetary-Gas Wind Tunnel. Test results indicate that the material, trade name Min-K 1301, should experience little ablation for heat transfer rates below 40 BTU/sq ft-sec. If the current design were to be changed so that the various pieces of Min-K were fastened or interlocked together the total amount of heat delivered to the RTG heat source during an earth orbital decay reentry would be reduced by at least 22.7%. Author

N72-15909*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF TEMPERATURE DATA FROM A FOUR-VANE STATIC CASCADE AND A RESEARCH GAS TURBINE ENGINE FOR A CHORDWISE-FINNED, IMPINGEMENT- AND FILM-COOLED VANE
Herbert J. Gladden, John N. B. Livingood, and Daniel J. Gauntner Washington Feb. 1972 33 p refs
(NASA-TM-X-2477; E-6597) Avail: NTIS CSCL 20M

Experimental heat-transfer data obtained for a chordwise-finned, impingement- and film-cooled turbine vane tested in a four-vane static cascade to a gas temperature and a gas pressure of 2250 F and 80 psia, respectively, are presented. Average and local vane temperatures are correlated and compared with correlations of temperature data obtained from tests of the same vane in a modified J-75 turbojet engine. The measured vane temperatures obtained from these tests in the two test stands are also compared with analytically determined temperatures. Author

N72-15910*# Kentucky Univ., Lexington. Boiling and Phase-Change Lab.
ON THE NONEXISTENCE OF PEAK AND MINIMUM BOILING HEAT FLUXES AT LOW GRAVITY
Nanik Bakhru and John H. Lienhard Mar. 1970 26 p refs Revised
(Grant NGR-18-001-035)
(NASA-CR-125422; TR-18-70-ME-5-Rev) Avail: NTIS

The peak pool boiling heat flux on horizontal cylinders is described. Zuber's values for the hydrodynamic transition heat fluxes are denoted. The low R' boiling mechanism is identified. A steady state advance of a vapor patch is represented, along with a vapor patch propagation sequence illustrating propagation of a vapor front. Bubble departure process within typical vapor patches from a platinum wire in saturated methanol is shown. J.A.M.

N72-15911*# Teledyne Brown Engineering, Huntsville, Ala.
INVESTIGATION OF SPACE STABLE THERMAL CONTROL COATING PROPERTIES Final Report
T. Mookherji Oct. 1971 32 p refs
(Contract NAS8-25900)
(NASA-CR-123491; SE-SSL-1410) Avail: NTIS CSCL 20M

A capability to study the nuclear magnetic resonance of spacecraft thermal control coating has been built utilizing an electromagnet and V-series and WI-series electronics. The electronics associated with the electromagnet had to be modified to make it compatible with the resonance measuring system. Resonance measurements have been performed on ZnO, Zn2TiO4 and FEP Teflon. The failure to observe resonance in ZnO and Zn2TiO4 has been theoretically explained. The linewidth and second moment measurements on ultraviolet irradiated FEP Teflon showed that there was no measurable degradation of the material due to short term irradiation. Author

N72-15912# Oak Ridge National Lab., Tenn.
ANALYSIS OF BUOYANT JETS WITHIN THE ZONE OF FLOW ESTABLISHMENT
Eric Hirst Aug. 1971 46 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3470) Avail: NTIS

The mathematical prediction of the physical properties in the zone of flow establishment (ZFE), for thermal effluents discharged as buoyant jets through round, submerged diffusers is presented. The ZFE is the region, immediately beyond the diffuser exit, in which the mean flow profiles undergo a transition from their internal flow shapes to a free turbulent flow condition. The method uses the integral equations of mass, energy, salt, and momentum conservation. The solution to these equations includes the length of the ZFE, and the values of jet width, jet orientation, and centerline temperature and salinity at the end of this zone. This method is quite general, capable of predicting buoyant jets with three dimensional trajectories discharged to flowing, stratified ambients. Author (NSA)

N72-15913# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Inst.
SEMI-EMPIRICAL THEORY OF THE HEAT EXCHANGE CRISIS DURING CHANNEL BOILING
P. L. Kirillov 1970 37 p refs In RUSSIAN
(FEI-224) Avail: AEC Depository Libraries

Several approaches to the study of the heat exchange crisis in channels were examined. These were purely empirical approaches based on a series of models from which a variety of formulas may be obtained. The basic equation of equilibrium in liquid films was analyzed, and methods were proposed for calculating separate components of this equation. It was shown that the use of two empirically determined quantities: (1) the fraction of the liquid flowing in a film and (2) the mass transfer coefficient contributes to a solution of the crisis problem. Author (NSA)

N72-15914# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
THERMODYNAMIC AND TRANSPORT PROPERTIES OF AIR AND CO2
M. A. M. Pirie Mar. 1971 34 p
(RD/B/M-1955) Avail: AEC Depository Libraries

The thermodynamic and transport properties necessary for heat transfer and gas flow experiments using air and CO2 are given in graphical form. They are presented in SI units with conversion factors to allow other systems of units to be obtained. Author (NSA)

N72-15915# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
VIBRATION OF U-BEND SEGMENTS OF HEAT EXCHANGER TUBES
Lester S. S. Lee May 1971 57 p refs
(AECL-3735) Avail: AEC Depository Libraries

Both pinned and clamped end conditions are discussed. Vibrations of an incomplete ring fall into two independent classes, namely, the in-plane flexural vibration and the coupled twist-bending out-of-plane vibration. Effective length of a curved rod is defined as a measure of stiffness as compared with an equivalent straight bar. Strain gages were used in a simple experimental test to measure the natural frequencies of the vibration of an incomplete ring of Type 304 stainless steel. Author (NSA)

N72-15916# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
HYPERSONIC LOW TEMPERATURE ABLATION: AN EXPERIMENTAL STUDY OF CROSS-HATCHED SURFACE PATTERNS
Hans W. Stock and J. J. Ginoux Jul. 1971 60 p refs
(VKI-TN-64) Avail: NTIS

Cross-hatching was studied experimentally at a free stream Mach number of 5.3, using two different low temperature ablative materials, camphor and wax, which sublime and liquefy, respectively. The surface pattern parameters were correlated with flow field properties, initial surface geometry, and ablative material properties. The effect of exposure time under ablation conditions was also studied. The validity of some hypotheses on the origin of cross-hatching was examined experimentally. The present results are compared with other available data. A brief review of previous experimental and theoretical work on cross-hatching is included. Author (ESRO)

N72-15917# ARO, Inc., Arnold Air Force Station, Tenn.
WIND TUNNEL TESTING OF INTERACTIONS OF HIGH ALTITUDE ROCKET PLUMES WITH THE FREE STREAM Final Report, 21 Apr. - 29 Oct. 1970
H. K. Smithson, L. L. Price, and D. L. Whitfield AEDC Sep. 1971 427 p refs
(Contract F40600-72-C-0003; ARO Proj. VT0030; ARO Proj. VQ0145)

(AD-731141; AEDC-TR-71-118; ARO-VKF-TR-71-41) Avail: NTIS CSCL 21/2

Interactions of model rocket plumes and the free stream at varying simulated altitudes have been investigated in an altitude simulation chamber. Free-stream variables were Mach number, gas, total temperature, and total pressure. Model rocket parameter variables were exhaust gas, area ratio, chamber total pressure and total temperature, and the orientation of the model relative to the free stream. In addition to pitot probe measurements, plume photographs and density measurements were obtained using the electron beam technique. Author (GRA)

N72-15918# Army Missile Command, Redstone Arsenal, Ala. Physical Sciences Directorate.

MEASUREMENT OF TEMPERATURE AND EMISSION OF LASER-HEATED LEAD SAMPLES DURING HEATING AND COOLING

Herbert B. Holl and Lonnine N. McClusky Jun. 1971 28 p ref (DA Proj. 1M2-62303-A-214)

(AD-731207; RR-TR-71-5) Avail: NTIS CSCL 20/13

Surface temperatures resulting from exposure of lead samples to a continuous wave laser beam were measured. The experiment used six sizes of square samples (2.5 to 10 cm on a side), all cut from sheets of 0.17-cm thickness. The CW-CO2 laser produced 45 watts maximum output power at 10.6-micrometers wavelength, and illuminated a spot size of about 0.4 sq cm on the samples. Iron/constantan thermocouples were attached at five or six locations on a sample and monitored temperatures during the heating and cooling period. The experimental results plotted as temperature versus time at various monitor points indicated that the cooling process is more rapid than the heating process. Data plotted as temperature profiles across the sample surface at various instants of time indicated that 1) the difference in temperature between the front and back of the sample was very slight, and 2) the center of the sample heated and cooled more rapidly than the sample edges.

Author (GRA)

N72-15919# Picatinny Arsenal, Dover, N.J.

RESPONSE OF ATLAS TYPE F SQUIBS TO VERY SHORT PULSES

A. Lloyd Charlton Sep. 1971 29 p ref

(AD-731206; PA-TM-2024) Avail: NTIS CSCL 19/1

The report presents results of tests to determine the voltage required for very short pulses to fire the squibs used in certain types of explosive switches. Pulses of 40 and 500 nanoseconds indicate that the firing energy is approximately constant and the firing voltage is related to the bridgewire resistance. It is also shown that pulses below the firing level affect both the bridgewire resistance and the squib sensitivity. Author (GRA)

N72-15920# Denver Research Inst., Colo. Dept. of Mechanical Engineering and Environmental Engineering.

THE IGNITION AND COMBUSTION OF SINGLE BORON PARTICLES IN AIR AT AMBIENT PRESSURE Final Report

William H. McLain and Louise A. Cotugno Aug. 1971 66 p refs

(Grant AF-AFOSR-1619-68; Task-971101)

(AD-731241; DRI-2576; AFOSR-71-2215TR; Rept-61102F; Rept-681308) Avail: NTIS CSCL 21/2

Experimental and theoretical studies are reported which provide basic information concerning the ignition and combustion processes of amorphous, crystalline, gamma-irradiated, and LiF coated single boron particles. All studies were conducted at ambient pressure with particles or particle agglomerates between 30 and 50 microns in diameter. Boron particles were suspended in a levitation cell and ignited using a pulsed neodymium-doped laser. The burning processes were recorded in either self-light or shadowgraph. Within experimental error the burning time for amorphous boron and spherodized crystalline boron are the same indicating that the initial particle character has a minor effect on the liquid droplet burning time combustion process. Analytical studies were made concerning the unsteady heating of boron particles subjected to high flux rates. The theory of nonequilibrium thermodynamics is explored and it is demonstrated that engineering calculations based on the equilibrium hypothesis may predict mass flux rates 50 to 100 percent in error.

Author (GRA)

N72-15921# Ballistic Research Labs., Aberdeen Proving Ground, Md. Exterior Ballistics Lab.

TRANSONIC RANGE TESTS OF 5-INCH/54 ROCKET-ASSISTED PROJECTILE (INERT)

William F. Donovan and Leonard C. MacAllister Jul. 1971 79 p refs

(Navy Proj. WR-6-0068; RDT/E Proj. 1T2-62301-A-201)

(AD-730661; BRL-MR-2107) Avail: NTIS CSCL 19/1

The aerodynamic properties of an inert full-scale model of an experimental rocket-assisted projectile (RAP) for use with the U. S. Navy 5-inch/54 gun as determined by ballistic range tests through Mach numbers from 0.75 to 2.24 are presented. Analysis of the data indicated nearly linear aerodynamic properties at supersonic speeds but a strong dependence of the Magnus moment on yaw at subsonic and transonic speeds.

Author (GRA)

N72-15922# Cornell Univ., Ithaca, N.Y. Dept. of Theroretical and Applied Mathematics.

MELTING OF AN INFINITE SOLID WITH A SPHERICAL CAVITY

Yuen Fung Lee Sep. 1971 59 p refs Based on a Ph.D. Thesis (Contract N00014-67-A-0077-0009; NR Proj. 064-401)

(AD-730511; TR-7) Avail: NTIS CSCL 20/13

The embedding technique is employed to obtain the short time exact analytical solution for the melting or solidification of an infinite body with a spherical hole or a concentric hollow sphere, with melting or solidification starting from the interior cavity. General cases of zero and infinite rates of ablation are considered, with particular emphasis on the Neumann problem and the case corresponding to a sudden rise of temperature. Numerical results are presented, and the validity and accuracy of the solutions are briefly discussed. Author (GRA)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N72-15923*+ National Aeronautics and Space Administration, Washington, D.C.

NASA THESAURUS ALPHABETICAL UPDATE: SUBJECT TERMS FOR INDEXING SCIENTIFIC AND TECHNICAL INFORMATION

Sep. 1971 619 p

(NASA-SP-7040) Avail: NTIS HC $9.00/MF $0.95 CSCL 05B

The NASA THESAURUS - ALPHABETICAL UPDATE is an alphabetical listing of all subject terms (postable and nonpostable) that are currently approved for use in the NASA scientific and technical information system. Contained in the listing are the subject terms that were listed in the Preliminary Edition of the NASA THESAURUS and the additional subject terms that were approved during the period January 1, 1967 June 30, 1971. Complete Thesaurus structuring, including scope notes, category assignments, and cross-references, is provided for each term as appropriate. Author

N72-15924 National Lending Library for Science and Technology, Boston Spa (England).

ON THE INFORMATION REQUIREMENTS OF EARTH

SCIENTISTS

T. Ya. Novikova Dec. 1971 11 p refs Transl. into ENGLISH from Nauch.-Tekh. Inform. Vses. Inst. Nauch. Tekh. Inform. Ser. 1 (Moscow), v. 8, 1971 p 9-12
(NLL-RTS-6921) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.10; 4 NLL photocopy coupons

The results of an examination of the information needs of earth scientists are presented within the framework of the various branches of this field. The general information needs of various groups of enquirers were evaluated according to their subject classification. Within each group, the relationship between the various types of information needs, i.e., current pertinent material, current nonpertinent material, retrospective pertinent material, and retrospective nonpertinent material, was considered. The evaluation of information needs of specialists was studied dynamically, relating to stages in their scientific and productive work programs. A number of additional problems were also solved. Author

N72-15925# Civil Aeronautics Board, Washington, D.C. Bureau of Economics.

CIVIL AERONAUTICS BOARD PLANNING STUDY. STOL - VTOL AIR TRANSPORTATION SYSTEMS

Carl Hintze, Jr. [1971] 37 p refs
Avail: NTIS

An analysis of the use of VTOL and STOL aircraft for short-haul transportation operations is presented. A description of the changing socio-economic aspects of the major metropolitan area of the nation and the anticipated effects on urban transportation requirements is included. The probable course of events in the evolution of short-haul operations is discussed. Author

N72-15926*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

CRIME PREDICTION MODELING Final Report

23 Apr. 1971 77 p refs
(Contract NAS7-100)
(NASA-CR-125405; JPL-STA-650-126) Avail: NTIS CSCL 05K

A study of techniques for the prediction of crime in the City of Los Angeles was conducted. Alternative approaches to crime prediction (causal, quasicausal, associative, extrapolative, and pattern-recognition models) are discussed, as is the environment within which predictions were desired for the immediate application. The decision was made to use time series (extrapolative) models to produce the desired predictions. The characteristics of the data and the procedure used to choose equations for the extrapolations are discussed. The usefulness of different functional forms (constant, quadratic, and exponential forms) and of different parameter estimation techniques (multiple regression and multiple exponential smoothing) are compared, and the quality of the resultant predictions is assessed. Author

N72-15927*# Philco-Ford Corp., Houston, Tex. WDL Div.

DEVELOPMENT OF MEDICAL DATA INFORMATION SYSTEMS Final Contract Report

J. Anderson 1 Nov. 1971 40 p
(Contract NAS9-11579)
(NASA-CR-115323; PHO-TR505) Avail: NTIS CSCL 05B

Computerized storage and retrieval of medical information is discussed. Tasks which were performed in support of the project are: (1) flight crew health stabilization computer system, (2) medical data input system, (3) graphic software development, (4) lunar receiving laboratory support, and (5) Statos V printer/plotter software development. Author

N72-15928*# Denver Research Inst., Colo. Industrial Economics Div.

PROJECT FOR THE ANALYSIS OF TECHNOLOGY TRANSFER Semiannual Report, 1 Jan. - 30 Jun. 1971

James P. Kottenstette, James E. Freeman, and Eileen R. Staskin Oct. 1971 97 p
(Contract NSR-06-004-063)
(NASA-CR-125399) Avail: NTIS CSCL 05B

The special task of preparing technology transfer profiles during the first six months of 1971 produced two major results: refining a new method for identifying and describing technology transfer activities, and generating practical insights into a number of issues associated with transfer programs. Author

N72-15929*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE NATIONAL SPACE SCIENCE DATA CENTER GUIDE TO INTERNATIONAL ROCKET DATA

Leland L. Dubach Jan. 1972 62 p refs
(NASA-TM-X-65800; X-601-72-2) Avail: NTIS CSCL 05B

Background information is given which briefly describes the mission of the National Space Science Data Center (NSSDC), including its functions and systems, along with its policies and purposes for collecting rocket data. The operation of a machine-sensible rocket information system, which allows the Data Center to have convenient access to information and data concerning all rocket flights carrying scientific experiments, is also described. The central feature of this system, an index of rocket flights maintained on magnetic tape, is described. Standard outputs for NSSDC and for the World Data Center A (WDC-A) for Rockets and Satellites are described. Author

N72-15930*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CARRIER ACCOUNT UTILIZATION AT THE GODDARD SPACE FLIGHT CENTER

W. E. Mathis and J. T. Langmead Jan. 1972 53 p
(NASA-TM-X-65793; X-210-71-490) Avail: NTIS CSCL 05A

The system in use at Goddard Space Flight Center for the utilization of the Common Use Service Carrier Account and the R&D Inventory Carrier Account technique for budgeting, accounting, financial control, and management reporting, both for the individual functional area and on a Center-wide basis, is documented. Author

N72-15931# Joint Publications Research Service, Washington, D.C.

FREE INFORMATION IN SOCIAL SYSTEMS

L. A. Khursin 20 Jan. 1972 28 p refs Transl. into ENGLISH from Nauchn.-Tekhn. Inform. (Moscow), no. 3, 1971 p 5-13
(JPRS-54983; CSO-1850-S; UDC-007) Avail: NTIS

The processes of transformation and creation of free information are discussed. Free information which occurs in the active region of a social system's information field are reflected in the information field's passive region on material carriers, which are for the most part in the form of publications. The chief process determining the formation of the social system's information field is that of the washing out of noise in the information field with time. This process includes the reappraisal of the correctness of associations established between facts already known to science. Author

N72-15932# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

ECONOMICS OF ENVIRONMENTAL QUALITY

R. T. Jaske [1971] 22 p refs Presented at the Environ. Workshop of Wash. State Federation of Women's Clubs and Wash. State Federation of Garden Clubs, North Bend, Wash., 12 Aug. 1971
(Contract AT(45-1)-1830)
(BNWL-SA-3983) Avail: NTIS

The effects of technological development on the ecology is discussed. The exact fraction of the total energy content of the biosphere that is required to support man is considered in terms of agriculture, mining and metallurgical processing, metropolitan development, and atmospheric modification by combustion and particulate emissions. Cost estimates for achieving substantial

reductions in environmental pollution are included. It is concluded that the problems of the environment will not be solved without conflict and deep changes in American institutions. F.O.S.

N72-15933# National Aerospace Lab., Amsterdam (Netherlands).
[ACTIVITIES OF THE NATIONAAL LUCHT- EN RUIMTEVAARTLABORATORIUM] Annual Report, 1969
[1970] 96 p refs In DUTCH; ENGLISH summary
Avail: NTIS

A survey is given of the activities in 1969 in the fields of applied aeronautical research, and the development of equipment. ESRO

N72-15934# National Aerospace Lab., Amsterdam (Netherlands).
[ACTIVITIES OF THE NATIONAAL LUCHT- EN RUIMTEVAARTLABORATORIUM] Annual Report, 1970
[1971] 108 p refs In DUTCH; ENGLISH summary
Avail: NTIS

A survey is given of the activities in 1970 in the fields of applied aeronautical research, and the development of equipment. ESRO

N72-15935# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
[ACTIVITIES OF THE OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES] Annual report, 1970
Jun. 1971 164 p refs In FRENCH and ENGLISH
Avail: NTIS

Specific tasks are reported, including: the investigation of supersonic combustion in a ramjet chamber; development of deterministic and stochastic optimization methods; turbulent boundary layer problems; tip vortices from helicopter blades; characteristics of control surfaces at Mach 10; large wind tunnel tests on Concorde and Mercure half models; comparison of wind tunnel tests on a convertible propellor at NASA Ames and SLMA Modane; aircraft aerodynamic flutter; studies for propulsion devices; materials studies for turbomachines and aircraft structures. ESRO

N72-15936# Centre National d'Etudes Spatiales, Paris (France).
[ACTIVITIES OF THE CENTRE NATIONAL D'ETUDES SPATIALES] Annual report, Jul. 1969 - Jul. 1970 [CENTRE NATIONAL D'ETUDES SPATIALES RAPPORT D'ACTIVITE, 1 JUILLET 1969 - 1 JUILLET 1970]
1970 136 p refs In FRENCH
Avail: NTIS

Activities carried out for the French space program are reviewed, including in-flight and under development satellites, the Diamand B launcher, sounding rockets, balloon sounding, and ground stations. Participation in international programs is reported. ESRO

N72-15937# Centre National d'Etudes Spatiales, Paris (France).
[ACTIVITIES OF THE CENTRE NATIONAL D'ETUDES SPATIALES] Annual report, Jul. 1968 - Jul. 1969 [CENTRE NATIONAL D'ETUDES SPATIALES RAPPORT D'ACTIVITE. 1 JUILLET 1968-1 JUILLET 1969]
1969 123 p In FRENCH
Avail: NTIS

Activities carried out for the French space program are reviewed, including in-flight studies and satellites under development, the Diamant B launcher, sounding rockets, balloon sounding, and ground stations. Participation in international progress is reported. ESRO

N72-15938# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
[ACTIVITIES OF THE DIVISION OF QUANTUM METROLOGY] Annual report, 1970
[1970] 50 p refs
(NPL-QU-AR-70) Avail: NTIS

The annual report of the Division of Quantum Metrology for 1970 is presented. The function of this division is to maintain and improve primary standards of measurement upon which the whole of science, technology, and industry depends. Research was undertaken to devise new and improved techniques of basing the standards of measurement upon the properties of atomic or molecular systems. ESRO

N72-15939# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
APPLICATION OF OPTIMIZATION METHODS IN DETERMINING PAYLOAD ALLOCATIONS FOR A FORCE OF PENETRATING AIRCRAFT M.S. Thesis
John R. Currey, Jr. Jun. 1971 143 p refs
(AD-731198; GSA/SM/71-01) Avail: NTIS CSCL 15/7

Allocation of the limited number of weapons spaces on a bomber became a problem when the availability of defensive missiles raised the possibility of a trade force. This study approaches the allocation problem by partitioning the enemy strategic heartland into discrete areas of constant defensive strength. A Monte Carlo simulation of the air battle between opposing offensive and defensive forces is used to determine the expected number of surviving bombers in each partition. With other factors held constant, the expected number of surviving bombers will be dependent on the quantity of defensive weapons available to them. This expected number of surviving bombers is used to generate a probability of bomber survival in each partition, for each possible load configuration of defensive weapons. Given the relative value of the targets available in each partition, a dynamic programming technique is utilized to enumerate all feasible weapon load configurations and to evaluate, using the associated probabilities of bomber survival, the expected return in target destruction generated by assignment of offensive weapons to those targets. The optimal allocation of weapon spaces is determined for simulated input data and the last chapter provides examples of other types of trade off analyses to which the model may be applied. Additional inferences are drawn with respect to the strategic doctrine which might call for this method of attack. Author (GRA)

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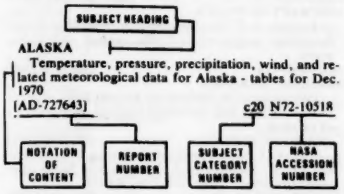
TYPICAL SUBJECT INDEX LISTING



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[NASA-TM-X-67594] c04 N72-15068
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POLYETHER RESINS
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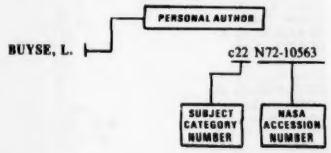

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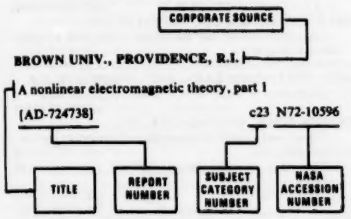

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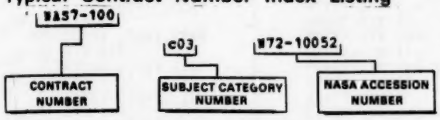

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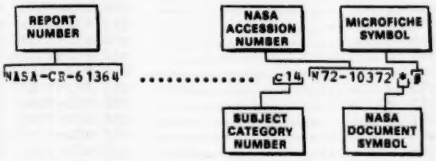

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NASA-CR-1924 ..... c12 N72-15264*#
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NASA-CR-1932 ..... c01 N72-14984*#
NASA-CR-1933 ..... c02 N72-14999*#
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NASA-CR-125416 ..... c25 N72-15666*#
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NASA-TM-X-2464 ..... c22 N72-15604*#
NASA-TM-X-2465 ..... c08 N72-15179*#
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NASA-TM-X-2485 ..... c01 N72-14987*#
NASA-TM-X-2493 ..... c22 N72-15609*#
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NASA-TM-X-67602 ..... c13 N72-15404*#
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NASA-TN-D-6597 ..... c02 N72-15000*#
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NASA-TN-D-6626 ..... c18 N72-15541*#
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NASA-TN-D-6635 ..... c26 N72-15689*#
NASA-TN-D-6637 ..... c01 N72-14986*#
NASA-TN-D-6639 ..... c19 N72-15557*#
NASA-TN-D-6640 ..... c01 N72-14983*#
NASA-TN-D-6647 ..... c01 N72-14988*#
NASA-TN-D-6649 ..... c17 N72-15521*#

NASA-TR-R-380 ..... c14 N72-15433*#

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NASA-TT-F-644 ..... c28 N72-15715*#
NASA-TT-F-650 ..... c04 N72-15028*#
NASA-TT-F-657 ..... c19 N72-15560*#
NASA-TT-F-695 ..... c30 N72-15747*#
NASA-TT-F-13782 ..... c13 N72-15325*#
NASA-TT-F-13839 ..... c23 N72-15620*#
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NASA-TT-F-14066 ..... c12 N72-15271*#
NASA-TT-F-14072 ..... c12 N72-15272*#
NASA-TT-F-14076 ..... c02 N72-15003*#
NASA-TT-F-14083 ..... c17 N72-15520*#
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NASA-TT-F-14089 ..... c12 N72-15263*#
NASA-TT-F-14094 ..... c04 N72-15027*#
NASA-TT-F-14096 ..... c05 N72-15094*#
NASA-TT-F-14102 ..... c05 N72-15100*#
NASA-TT-F-14104 ..... c31 N72-15778*#
NASA-TT-F-14107 ..... c12 N72-15274*#
NASA-TT-F-14111 ..... c12 N72-15273*#
NASA-TT-F-14115 ..... c07 N72-15141*#
NASA-TT-F-14137 ..... c13 N72-15326*#

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NAVMED-M4311.01-1003BAC5-3 ..... c04 N72-15088 #

NAVSO-P-3012 ..... c30 N72-15749 #

NBS-BSS-40 ..... c13 N72-15317 #

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NHK-LABS-NOTE-141 ..... c08 N72-15163 #

NLL-AERE-TR-1139 ..... c24 N72-15641

NLL-CE-TR-5192 ..... c26 N72-15686

NLL-CE-TR-5543-(9022.09) c15 N72-15457
NLL-CE-TR-5639-(9022.09) c08 N72-15162

NLL-CTO-770-(9091.9F) c25 N72-15664

NLL-LIB-COMM-1604-(5196) c20 N72-15568

NLL-M-21166-(5828.4F) c26 N72-15687
NLL-M-21167-(5828.4F) c32 N72-15870
NLL-M-21190-(5828.4F) c17 N72-15505
NLL-M-21204-(5828.4F) c06 N72-15122
NLL-M-21216-(5828.4F) c17 N72-15516

NLL-RISLEY-TR-2099-(9091.9F) c22 N72-15602
NLL-RISLEY-TR-2242-(9091.9F) c15 N72-15456
NLL-RISLEY-TR-2256-(9091.9F) c22 N72-15603

NLL-RST-6899 ..... c06 N72-15124

NLL-RTS-6560 ..... c28 N72-15710
NLL-RTS-6561 ..... c15 N72-15458
NLL-RTS-6687 ..... c06 N72-15123
NLL-RTS-6812 ..... c17 N72-15514
NLL-RTS-6921 ..... c34 N72-15924

NLL-TRANS-746-882-(9022.401) c17 N72-15513
NLL-TRANS-746-922-(9022.401) c32 N72-15871
NLL-TRANS-746-931-(9022.401) c17 N72-15511
NLL-TRANS-746-932-(9022.401) c17 N72-15512
NLL-TRANS-746-955-(9022-401) c17 N72-15510
NLL-TRANS-746-985-(9022.401) c17 N72-15515
NLL-TRANS-746-1002-(9022.401) c17 N72-15508
NLL-TRANS-746-1045-(9022.401) c17 N72-15509
NLL-TRANS-746-1060-(9022.401) c17 N72-15506
NLL-TRANS-748-938-(9022.401) c17 N72-15507
NLL-TRANS-843-(9022.64) c14 N72-15407

NLR-TR-71003-U-REV ..... c17 N72-15529 #

NMAB-284 ..... c26 N72-15699 #

NMC-TP-71-52 ..... c02 N72-15013 #

NMFRL-VOL-21/NO-21 ..... c04 N72-15088 #

NOAA-FCM-71-5 ..... c20 N72-15575 #

NOAA-ISPDA-FA-320 ..... c13 N72-15333

NOAA-TR-ERL-209-APCL-22 ..... c20 N72-15574 #

NOAA-71083002 ..... c20 N72-15590 #

NOLTR-71-61 ..... c03 N72-15025 #
NOLTR-71-111 ..... c02 N72-15017 #

NOTA-INTERNA-299 ..... c24 N72-15659 #
NOTA-INTERNA-310 ..... c24 N72-15660 #
NOTA-INTERNA-314 ..... c19 N72-15563 #
NOTA-INTERNA-316 ..... c24 N72-15661 #

NP-18943 ..... c09 N72-15212 #
NP-18960 ..... c29 N72-15728 #
NP-18962 ..... c29 N72-15727 #
NP-18963 ..... c25 N72-15669 #
NP-18972 ..... c25 N72-15675 #
NP-18976 ..... c13 N72-15366 #
NP-18977 ..... c13 N72-15367 #
NP-18978 ..... c11 N72-15247 #

NPL-NAC-2 ..... c12 N72-15293 #

NPL-QU-AR-70 ..... c34 N72-15938 #

NPL-QU-18 ..... c25 N72-15680 #

NRL-H02-27B ..... c25 N72-15684 #

NRL-M01-24 ..... c17 N72-15537 #

NRL-N01-24 ..... c16 N72-15501 #

NRL-7278 ..... c17 N72-15537 #
NRL-7287 ..... c16 N72-15501 #
NRL-7301 ..... c25 N72-15684 #

NSRDC-6-103 ..... c14 N72-15453 #

NSRDL/A-6-88/70 ..... c23 N72-15635 #

NSSA-R40-70-3 ..... c28 N72-15720 #

NTSB-AAR-71-16 ..... c02 N72-15005 #

NUC-TP-259 ..... c08 N72-15191 #

NUP-A-71-15 ..... c24 N72-15643 #

NVO-1163-TM-28 ..... c07 N72-15144 #

NWC-TP-5204 ..... c18 N72-15553 #

OCEANOG-SER-A-NO-47 ..... c13 N72-15306

ONERA-1/253-GY-PT-1/5 ..... c12 N72-15271*#

ONR-ACR-177 ..... c13 N72-15321 #

ONRL-R-32-71 ..... c25 N72-15683 #

ORNL-C-15-71 ..... c10 N72-15235 #

ORNL-TM-3470 ..... c33 N72-15912 #
ORNL-TM-3491 ..... c24 N72-15652 #
ORNL-TM-3538 ..... c22 N72-15614 #

ORNL-TR-2495 ..... c23 N72-15629 #
ORNL-TR-2510 ..... c23 N72-15630 #

ORNL-4693 ..... c22 N72-15613 #

OSD-1366 ..... c11 N72-15253 #
OSD-1366 ..... c14 N72-15452 #

OT/ITSTM-19 ..... c21 N72-15598 #

P-4707 ..... c08 N72-15181 #
P-4710 ..... c08 N72-15180 #
P-4715 ..... c19 N72-15561 #

PA-TM-2024 ..... c33 N72-15919 #

PAPER-I-4 ..... c13 N72-15371 #

PAPER-599-G ..... c30 N72-15759*#

PB-204472 ..... c13 N72-15383*#

PDO-6984549 ..... c14 N72-15444 #

PHO-TN516 ..... c08 N72-15176*#

PHO-TR505 ..... c34 N72-15927*#

PITR-311 ..... c13 N72-15389 #

PM/71/6 ..... c24 N72-15642 #

PPG-99 ..... c13 N72-15384 #

PPL-NP7 ..... c25 N72-15681 #

PRC-H-101 ..... c15 N72-15460*#

PREPRINT-B-0109 ..... c11 N72-15247 #

PREPRINT-6 ..... c09 N72-15212 #
PREPRINT-72 ..... c25 N72-15675 #

PSR-99/8 ..... c32 N72-15882 #

PSU-IRL-SCI-374 ..... c06 N72-15133*#

PUBL-119 ..... c14 N72-15445 #

PWA-3975 ..... c03 N72-15023*#

P13-5016 ..... c23 N72-15620*#

QPR-1 ..... c07 N72-15159 #
QPR-8 ..... c13 N72-15308*#

QR-4 ..... c26 N72-15695 #
QR-4-PT-4 ..... c20 N72-15581 #
QR-6 ..... c18 N72-15555 #

R-24 ..... c13 N72-15377 #
R-690-RR ..... c05 N72-15107 #

RADC-TR-71-142 ..... c08 N72-15190 #
RADC-TR-71-167 ..... c13 N72-15400 #
RADC-TR-71-170 ..... c09 N72-15221 #

RAE-TR-69237 ..... c32 N72-15880 #
RAE-TR-70002 ..... c09 N72-15216 #
RAE-TR-70086 ..... c10 N72-15232 #
RAE-TR-70196 ..... c09 N72-15215 #
RAE-TR-70227 ..... c15 N72-15482 #
RAE-TR-71005 ..... c09 N72-15214 #
RAE-TR-71043 ..... c12 N72-15292 #
RAE-TR-71046 ..... c01 N72-14996 #
RAE-TR-71099 ..... c07 N72-15150 #

RD/B/N-1955 ..... c33 N72-15914 #

RDR-1698 ..... c14 N72-15449 #

REPT-1 ..... c30 N72-15775 #
REPT-1/253-GY-PT-2/5 ..... c12 N72-15272*#
REPT-2 ..... c04 N72-15076 #
REPT-2 ..... c16 N72-15503 #
REPT-3 ..... c30 N72-15755 #
REPT-4 ..... c14 N72-15428 #
REPT-9G77-F ..... c02 N72-15004*#
REPT-31 ..... c13 N72-15367 #
REPT-33 ..... c13 N72-15366 #
REPT-36 ..... c04 N72-15070*#
REPT-56 ..... c23 N72-15639 #
REPT-60 ..... c23 N72-15638 #
REPT-61 ..... c23 N72-15637 #
REPT-69-11-VOL-1 ..... c01 N72-14990*#
REPT-71-C-180 ..... c26 N72-15691 #
REPT-71-4 ..... c12 N72-15270 #
REPT-71-20 ..... c25 N72-15679 #
REPT-71-81 ..... c12 N72-15304 #
REPT-71-6192-1 ..... c04 N72-15069*#
REPT-302-W ..... c06 N72-15132 #
REPT-551.506.1(480) ..... c20 N72-15573 +
REPT-1003/71 ..... c08 N72-15188 #
REPT-1004/71 ..... c08 N72-15187 #
REPT-1005/71 ..... c08 N72-15189 #
REPT-1506-4-R7 ..... c05 N72-15093*+
REPT-1960-71 ..... c22 N72-15608*#
REPT-2902-4 ..... c19 N72-15558*#
REPT-6478 ..... c09 N72-15201 #
REPT-7620-71-001 ..... c10 N72-15228*#
REPT-12225-FR(R) ..... c02 N72-15019 #
REPT-61102F ..... c05 N72-15110 #
REPT-61102F ..... c18 N72-15552 #
REPT-61102F ..... c25 N72-15682 #
REPT-61102F ..... c32 N72-15882 #
REPT-61102F ..... c32 N72-15884 #
REPT-61102F ..... c33 N72-15920 #
REPT-027980-2-F ..... c13 N72-15385 #
REPT-037250-3 ..... c09 N72-15221 #
REPT-681301 ..... c24 N72-15663 #
REPT-681304 ..... c25 N72-15682 #
REPT-681304 ..... c32 N72-15882 #
REPT-681307 ..... c18 N72-15552 #
REPT-681307 ..... c32 N72-15884 #
REPT-681308 ..... c33 N72-15920 #
REPT-681313 ..... c05 N72-15110 #
REPT-6144501F ..... c24 N72-15663 #

REQ-00173-9-006346/1-12-70 ..... c25 N72-15681 #

RFP-TRANS-79 ..... c32 N72-15878 #

RK-TR-71-15 ..... c27 N72-15709 #

RR-TR-71-5 ..... c33 N72-15918 #

RRC-71-R-257 ..... c28 N72-15723 #

RT/CHI(70)45 ..... c24 N72-15654 #
RT/PROT-(71)16 ..... c14 N72-15440 #

SACLANTCEN-TM-151 ..... c14 N72-15437 #
SACLANTCEN-TM-152 ..... c23 N72-15628 #
SACLANTCEN-TM-167 ..... c09 N72-15219 #

SACLANTCEN-TR-170 ..... c13 N72-15363 #
SACLANTCEN-TR-181 ..... c13 N72-15322 #

SAM-REVIEW-2-71 ..... c05 N72-15119 #

SAM-TR-71-8 ..... c04 N72-15085 #

SAM-TR-71-13 ..... c05 N72-15119 #
SAM-TR-71-14 ..... c02 N72-15016 #
SAM-TR-71-19 ..... c04 N72-15082 #
SAM-TR-71-22 ..... c02 N72-15014 #
SAM-TR-71-30 ..... c04 N72-15086 #
SAM-TR-71-33 ..... c15 N72-15485 #

SAM-TT-R-1107-0971-PT-1 ..... c04 N72-15091 #
SAM-TT-R-1108-0971-PT-2 ..... c04 N72-15092 #
SAM-TT-R-1111-0971 ..... c04 N72-15084 #

SAMSO-TR-71-82-VOL-1 ..... c13 N72-15397 #
SAMSO-TR-71-82-VOL-2 ..... c13 N72-15388 #
SAMSO-TR-71-144 ..... c06 N72-15137 #
SAMSO-TR-71-148 ..... c13 N72-15406*#
SAMSO-TR-71-149 ..... c15 N72-15484 #
SAMSO-TR-71-211 ..... c29 N72-15733 #

SAPR-3 ..... c27 N72-15708 #
SAPR-21 ..... c25 N72-15669 #

SAR-1 ..... c09 N72-15220 #
SAR-1 ..... c17 N72-15517*#
SAR-2 ..... c16 N72-15496 #

SATR-3 ..... c16 N72-15500 #
SATR-4 ..... c16 N72-15499 #
SATR-5 ..... c16 N72-15498 #

SC-DC-70-5386 ..... c24 N72-15651 #
SC-DC-713816 ..... c09 N72-15210 #

SC-DR-710299 ..... c09 N72-15209 #

SC-M-710477 ..... c08 N72-15182 #

SC-RR-710008-REV ..... c20 N72-15578 #
SC-RR-710326 ..... c32 N72-15877 #

SC-T-713055 ..... c16 N72-15493 #
SC-T-713057 ..... c16 N72-15495 #
SC-T-713058 ..... c16 N72-15494 #

SD-71-211 ..... c31 N72-15787*#
SD-71-256 ..... c31 N72-15780*#
SD-71-342-VOL-2 ..... c31 N72-15777*#
SD-71-346 ..... c31 N72-15786*#

SD70-556-1-VOL-1 ..... c15 N72-15471*#
SD70-559-1 ..... c15 N72-15463*#
SD70-559-2 ..... c15 N72-15464*#

SE-SSL-1410 ..... c33 N72-15911*#

SER-H-0404.00 ..... c31 N72-15788*#

SJC-T-70-4 ..... c08 N72-15184 #

SNC-2708-3 ..... c18 N72-15547 #

SR-3 ..... c07 N72-15160 #
SR-12 ..... c07 N72-15157 #
SR-14 ..... c07 N72-15158 #

SRCC-161 ..... c24 N72-15647*#

SRDE-70044 ..... c09 N72-15217 #
SRDE-70049 ..... c26 N72-15696 #
SRDE-70062 ..... c07 N72-15148 #
SRDE-71006 ..... c26 N72-15697 #
SRDE-71007 ..... c26 N72-15698 #

SRR-72-7 ..... c05 N72-15109 #

SSL-SER-12-ISSUE-51 ..... c29 N72-15735*#
SSL-SER-12-ISSUE-54 ..... c13 N72-15404*#
SSL-SER-12-ISSUE-55 ..... c29 N72-15736*#
SSL-SER-12-ISSUE-64 ..... c14 N72-15448 #

STOCK-0303-0940 ..... c13 N72-15317 #

SU-SEL-70-076 ..... c09 N72-15222 #
SU-SEL-71-046-VOL-1 ..... c13 N72-15397 #
SU-SEL-71-047-VOL-2 ..... c13 N72-15388 #

SU-TR-6560-23 ..... c09 N72-15222 #

SUDAAR-423 ..... c12 N72-15303 #

SURC-TR-71-169 ..... c07 N72-15155 #

TH-71-E-20 ..... c04 N72-15073 #

THEMIS-603 ..... c05 N72-15106 #

TI-59009-6 ..... c14 N72-15450 #

TID-4500 ..... c12 N72-15286 #
TID-4500 ..... c26 N72-15693 #

TM-71-5 ..... c27 N72-15708 #

TN-4-71 ..... c05 N72-15118 #
TN-1971-33 ..... c13 N72-15398 #
TN-1971-39 ..... c31 N72-15809 #

TR-1 ..... c18 N72-15552 #
TR-1-CU-1-71 ..... c13 N72-15391 #
TR-1-CU-1-71 ..... c13 N72-15391 #
TR-2 ..... c32 N72-15884 #
TR-3 ..... c08 N72-15164*#
TR-3-CU-371 ..... c13 N72-15391 #
TR-5 ..... c17 N72-15535 #
TR-7 ..... c07 N72-15140 #
TR-7 ..... c33 N72-15922 #
TR-10 ..... c26 N72-15703 #
TR-12 ..... c26 N72-15702 #
TR-13 ..... c32 N72-15883 #
TR-13-1 ..... c32 N72-15890 #
TR-13-2 ..... c32 N72-15889 #
TR-14 ..... c32 N72-15875 #
TR-15 ..... c04 N72-15081 #
TR-18-70-ME-5-REV ..... c33 N72-15910*#
TR-22 ..... c32 N72-15881 #
TR-71-1 ..... c07 N72-15161 #
TR-71-3 ..... c25 N72-15665*#
TR-166 ..... c01 N72-14984*#
TR-231-30 ..... c12 N72-15298 #
TR-231-31 ..... c12 N72-15299 #
TR-582-F ..... c16 N72-15497 #
TR-582-2 ..... c16 N72-15496 #
TR-582-3 ..... c16 N72-15500 #
TR-582-4 ..... c16 N72-15499 #
TR-582-5 ..... c16 N72-15498 #
TR-0172(52816-60)-1 ..... c12 N72-15301 #
TR-0172(2230-20)-1 ..... c29 N72-15733 #
TR-0172(2260-20)-5 ..... c13 N72-15406*#
TR-0172(9250-03)-1 ..... c15 N72-15484 #

TRITA-EPP-71-08 ..... c25 N72-15678 #
TRITA-EPP-71-21 ..... c13 N72-15373 #
TRITA-EPP-71-24 ..... c30 N72-15771 #

TRW-ER-7506 ..... c17 N72-15517*#

TT-70-50112 ..... c30 N72-15750*#
TT-70-50115 ..... c28 N72-15715*#
TT-70-50186 ..... c19 N72-15560*#

T702301-2301 ..... c04 N72-15074 #

U-376-222 ..... c23 N72-15636 #

UAG-12-PT-2 ..... c13 N72-15319 #
UAG-12-PT-3 ..... c13 N72-15320 #
UAG-16 ..... c13 N72-15318 #

UC-80 ..... c22 N72-15613 #

UCLA-ENG-7120 ..... c14 N72-15451 #
UCLA-ENG-7135 ..... c19 N72-15565 #

UCRL-51072 ..... c11 N72-15246 #
UCRL-72848 ..... c05 N72-15103 #
UCRL-73038 ..... c25 N72-15676 #
UCRL-73158 ..... c22 N72-15610 #

UCSD-34-P-163-X-2 ..... c24 N72-15649 #

UDC-62-503.4 ..... c10 N72-15227 #
UDC-007 ..... c34 N72-15931 #
UDC-532.63 ..... c06 N72-15130 #
UDC-533.696.4:533.6.011.5:083 ..... c12 N72-15269 #
UDC-550.382.7(262.5) ..... c13 N72-15335 #
UDC-550.385.43 ..... c13 N72-15334 #
UDC-551.551.5 ..... c20 N72-15584 #
UDC-613.648.613.693 ..... c30 N72-15761 #

UDC-621.374.4 ..... c09 N72-15216 #
UDC-621.391.812.8 ..... c07 N72-15139
UDC-629.7.015:519.3 ..... c19 N72-15560*#

UDS-615.849.19.015.4:612.79 ..... c04 N72-15066 #

UJV-2526-M ..... c17 N72-15526 #

UMICH-01357-11-INT-MOD-1 ..... c12 N72-15267 #
UMICH-01357-22-T ..... c33 N72-15905 #
UMICH-03371-15-I ..... c12 N72-15268 #
UMICH-03371-15-T ..... c33 N72-15906 #

US-PATENT-APPL-SN-20673 ..... c14 N72-15432*#
US-PATENT-APPL-SN-51246 ..... c15 N72-15465*#
US-PATENT-APPL-SN-57252 ..... c14 N72-15422*#
US-PATENT-APPL-SN-59893 ..... c15 N72-15468*#
US-PATENT-APPL-SN-59894 ..... c23 N72-15622*#
US-PATENT-APPL-SN-59968 ..... c15 N72-15466*#
US-PATENT-APPL-SN-60881 ..... c32 N72-15874*#
US-PATENT-APPL-SN-63195 ..... c14 N72-15417*#
US-PATENT-APPL-SN-66004 ..... c15 N72-15467*#
US-PATENT-APPL-SN-69488 ..... c06 N72-15129*#
US-PATENT-APPL-SN-70032 ..... c11 N72-15241*#
US-PATENT-APPL-SN-71048 ..... c18 N72-15543*#
US-PATENT-APPL-SN-73283 ..... c15 N72-15474*#
US-PATENT-APPL-SN-73310 ..... c09 N72-15195*#
US-PATENT-APPL-SN-73422 ..... c15 N72-15470*#
US-PATENT-APPL-SN-73922 ..... c14 N72-15426*#
US-PATENT-APPL-SN-74759 ..... c14 N72-15420*#
US-PATENT-APPL-SN-77220 ..... c14 N72-15421*#
US-PATENT-APPL-SN-77785 ..... c09 N72-15204*#
US-PATENT-APPL-SN-77786 ..... c14 N72-15425*#
US-PATENT-APPL-SN-78717 ..... c05 N72-15097*#
US-PATENT-APPL-SN-80368 ..... c09 N72-15200*#
US-PATENT-APPL-SN-81096 ..... c14 N72-15429*#
US-PATENT-APPL-SN-82280 ..... c09 N72-15205*#
US-PATENT-APPL-SN-84002 ..... c08 N72-15177*#
US-PATENT-APPL-SN-87222 ..... c05 N72-15096*#
US-PATENT-APPL-SN-87223 ..... c15 N72-15476*#
US-PATENT-APPL-SN-87551 ..... c33 N72-15893*#
US-PATENT-APPL-SN-90594 ..... c08 N72-15178*#
US-PATENT-APPL-SN-94347 ..... c05 N72-15095*#
US-PATENT-APPL-SN-94374 ..... c14 N72-15418*#
US-PATENT-APPL-SN-98517 ..... c09 N72-15199*#
US-PATENT-APPL-SN-98772 ..... c08 N72-15174*#
US-PATENT-APPL-SN-98773 ..... c15 N72-15475*#
US-PATENT-APPL-SN-98774 ..... c14 N72-15415*#
US-PATENT-APPL-SN-98798 ..... c09 N72-15198*#
US-PATENT-APPL-SN-99174 ..... c14 N72-15431*#
US-PATENT-APPL-SN-99175 ..... c09 N72-15196*#
US-PATENT-APPL-SN-99201 ..... c15 N72-15462*#
US-PATENT-APPL-SN-100774 ..... c06 N72-15128*#
US-PATENT-APPL-SN-103078 ..... c15 N72-15469*#
US-PATENT-APPL-SN-103090 ..... c14 N72-15430*#
US-PATENT-APPL-SN-145027 ..... c06 N72-15127*#
US-PATENT-APPL-SN-162100 ..... c09 N72-15206*#
US-PATENT-APPL-SN-189290 ..... c14 N72-15427*#
US-PATENT-APPL-SN-190316 ..... c17 N72-15519*#
US-PATENT-APPL-SN-190970 ..... c15 N72-15472*#
US-PATENT-APPL-SN-192970 ..... c28 N72-15714*#
US-PATENT-APPL-SN-198285 ..... c09 N72-15197*#
US-PATENT-APPL-SN-198355 ..... c05 N72-15098*#
US-PATENT-APPL-SN-198379 ..... c15 N72-15473*#
US-PATENT-APPL-SN-198380 ..... c31 N72-15781*#

USA-NLABS-72-3-CE ..... c05 N72-15115 #

USAARL-71-20 ..... c05 N72-15111 #

USAEHA-42-014-70 ..... c04 N72-15079 #

USAFETAC-TN-71-10 ..... c20 N72-15586 #

UTIAS-163 ..... c32 N72-15876 #
UTIAS-176 ..... c02 N72-15002 #

VKI-TN-64 ..... c33 N72-15916 #
VKI-TN-74 ..... c12 N72-15291 #

VTH-167 ..... c12 N72-15277 #

WANL-RR(VVV)-002 ..... c17 N72-15518*#

WASH-1183 ..... c24 N72-15650 #

WHOI-REF-71-50 ..... c13 N72-15399 #

WORK-UNIT-2 ..... c05 N72-15108 #

WORKING-PAPER-140-2 ..... c02 N72-15020 #
WORKING-PAPER-59111-8 ..... c05 N72-15121 #

WR-71-9 ..... c02 N72-15015 #
WR-71-13 ..... c05 N72-15121 #

WVT-7139 ..... c32 N72-15887 #

X-210-71-490 ..... c34 N72-15930*#
X-511-71-520 ..... c07 N72-15142*#
X-550-71-505 ..... c30 N72-15756*#
X-551-71-494 ..... c14 N72-15435*#
X-601-72-2 ..... c34 N72-15929*#
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